N00204.AR.004218
NAS PENSACOLA
5090.3a

RISK BASED CLOSURE REQUEST FOR UNDERGROUND STORAGE TANK SITE 1120 BRONSON FIELD NAS PENSACOLA FL

9/1/2008

TETRA TECH

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
09/03/08

Risk-Based Closure Request
for
Underground Storage Tank (UST)
Site 1120

Outlying Landing Field (OLF) Bronson
Pensacola, Florida

Contract Task Order 0072

September 2008

NAVFAC
Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

RISK-BASED CLOSURE REQUEST
FOR
UNDERGROUND STORAGE TANK (UST)
SITE 1120

OUTLYING LANDING FIELD (OLF) BRONSON
PENSACOLA, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0072

SEPTEMBER 2008

PREPARED UNDER THE SUPERVISION OF:

GERALD WALKER
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

APPENDIX

TABLES

NUMBER **PAGE NO.**

FIGURES

NUMBER **PAGE NO.**

ACRONYMS AND ABBREVIATIONS

µg/L	microgram/liter
bgs	below ground surface
CLEAN	Comprehensive Long-term Environmental Action Navy
cm^2	centimeter squared
COC	Contaminant of concern
C_{sat}	soil saturation concentrations
CTL	Cleanup Target Level
CSF	cancer slope factor
CTO	Contract Task Order
DA_{event}	absorbed dose per event
EPC	exposure point concentration
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
GCTL	groundwater cleanup target levels
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HQ	hazard Quotient
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
m^3	cubic meter
mg	milligrams
mg/kg	milligram per kilogram
MOP	Monitoring Only Plan
NA	natural attenuation
NADSC	Natural Attenuation Default Source Concentrations
NAS	Naval Air Station
NAVFAC SE	Naval Facilities Engineering Command, Southeast
NCEA	National Center for Environmental Assessment
OLF	Outlying Landing Field
ORC®	Oxygen-Release Compound
PAH	polynuclear aromatic hydrocarbon
PEF	Particulate Emissions Factor
PPRTV	Provisional Peer Reviewed Toxicity Value
PRG	Preliminary Remediation Goal
RAGS	Risk Assessment Guidance for Superfund

ACRONYMS AND ABBREVIATIONS (Continued)

RBC	Risk-Based Concentration
RBCA	Risk-Based Corrective Action
RBCAP	risk-based corrective action process
RfD	reference dose
RME	Reasonable Maximum Exposure
RMO	Risk Management Option
SAR	Site Assessment Report
SCTL	soil cleanup target levels
TEF	Toxicity Equivalence Factors
TPH	total petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VF	Volatilization Factor
VOC	volatile organic compound

1.0 INTRODUCTION

This Risk-Based Closure Request has been prepared by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62467-04-R-0055 Contract Task Order (CTO) 0072. This Risk-Based Closure Request has been prepared to assess the potential human health exposure concerns for the residual contamination at Site 1120, a petroleum site, at Outlying Landing Field (OLF) Bronson, which is part of Naval Air Station (NAS) Pensacola. This Risk-Based Closure Request has been prepared in accordance with the Florida Department of Environmental Protection (FDEP) Global Risk-Based Corrective Action (RBCA) rule [Chapter 62-780, Florida Administrative Code (FAC)]. As part of the Risk-Based Closure Request process, TtNUS evaluated the potential risk associated with current and potential future land use based exposure to the residual contamination in soil and groundwater.

1.1 SITE HISTORY

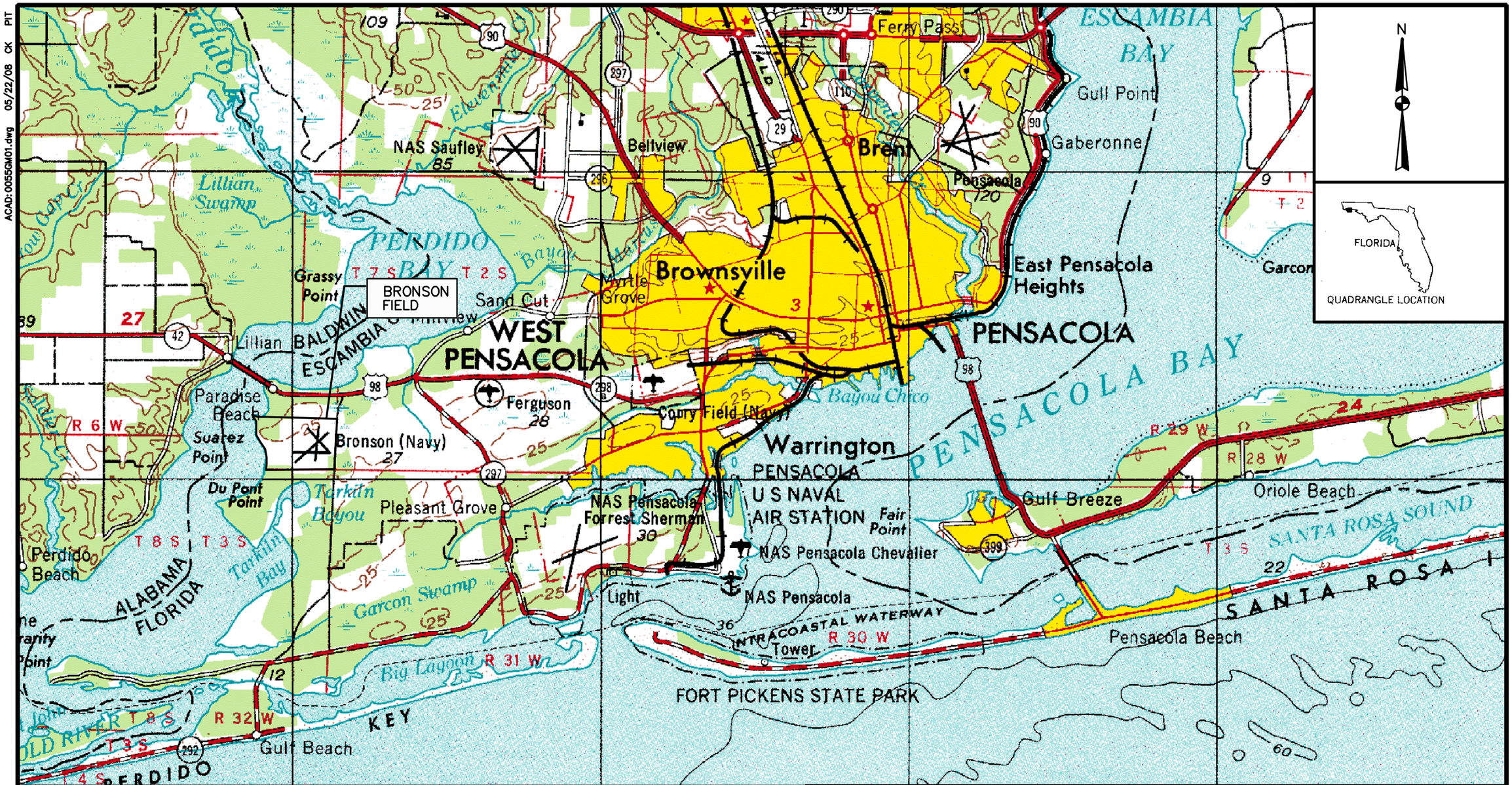
OLF Bronson is located in Escambia County, Florida (Figure 1-1). OLF Bronson was constructed in the early 1940's and used as a training base for Naval aviators during World War II and the Korean War. OLF Bronson was closed as an active airfield in 1950, but the runways were still used for helicopter training. Dismantling of OLF Bronson began in 1950 and by 1968 all buildings at OLF Bronson had been razed.

Site 1120 is the former location of a boiler room (Building 1120) at OLF Bronson (Figure 1-2). Three concrete underground storage tanks (USTs) used to store fuel oil and one 250-gallon steel UST used to store butane were removed from Site 1120 in 1994. Approximately 200 cubic yards of soil were removed from the excavation during removal of the tanks and clean soil was used to backfill the excavation. Petroleum hydrocarbon vapors were noted in the soil during the removal of the USTs and analytical results of groundwater samples collected from a monitoring well indicated petroleum contamination of the groundwater (concentrations greater than allowable state target levels).

Investigations at the site have included the UST Closure Assessments completed in July 1994 and May 1995, and the initial Site Assessment field investigation completed in August 1997. In March 1998, the Site Assessment Report (SAR) based on the findings of these investigations was submitted (Navy Public Works Center, March 1998).

Upon review of the SAR, the FDEP issued a technical review letter which requested additional site assessment in order to meet the requirements of Chapter 62-770, FAC (FDEP, April 1998). The SAR addendum investigation was conducted in July 2000. Based on the additional site assessment data, the

ACAD: 0055GM01.dwg 05/22/08 CK PIT



SOURCE: USGS TOPOGRAPHIC QUADRANGLE
PENSACOLA, FLORIDA-ALABAMA (1957 EDITION)

DRAWN BY / DATE	CK 5/22/08
CHECKED BY / DATE	
REVISED BY / DATE	
SCALE	NOT TO SCALE

SITE LOCATION MAP
UST SITE 1120
OUTLYING LANDING FIELD BRONSON
PENSACOLA, FLORIDA

CONTRACT NO.	0055
OWNER NO.	0000
APPROVED BY / DATE	
DRAWING NO.	FIGURE 1-1
REV.	0

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

ACAD:0055GM09.dwg 05/22/08 CK PIT

N

7.0
7.5
8.0
8.0
7.5
6.5
6.5
7.0

MW-17 (DRY)
MW-7 (7.73)
DMW-34 (8.28)
FORMER LOCATION OF BUTANE STORAGE TANK
MW-19 (7.68)
MW-13R (7.31)
FORMER LOCATION OF FUEL OIL STORAGE TANKS
MW-27 (6.80)
MW-18 (DRY)
MW-36 (7.11)
MW-3 (DRY)
EXISTING CONCRETE SLAB (FORMER BUILDING 1120-1)
MW-2 (7.98)
MW-8 (DRY)
MW-20 (DRY)
MW-37 (6.86)
MW-25 (7.01)
MW-1 (NM)
MW-4R (DRY)
MW-11 (DRY)
MW-9 (NM)
SB03
MW-15 (DRY)
MW-5R (7.64)
SB01
MW-21 (7.58)
MW-6 (NM)
MW-28 (6.60)
DIRT ROAD
MW-10 (7.90)
SB02
MW-26 (NM)
MW-14R (7.07)
DMW-35 (NM)
MW-38 (6.82)
MW-16R (7.13)
MW-12 (NM)
MW-33 (DRY)
DMW-39 (6.80)
MW-22 (7.30)
MW-40 (6.90)
MW-29 (6.68)
MW-24 (6.89)
MW-32 (6.52)
MW-23 (7.26)
MW-30 (6.67)
MW-31 (6.85)

LEGEND:

MW-22	MONITORING WELL LOCATION AND DESIGNATION
DMW-35	DEEP MONITORING WELL LOCATION AND DESIGNATION
SB01	SOIL BORING LOCATION AND DESIGNATION
7.0	CONTOUR ELEVATION (DASHED WHERE INFERRED)
→	GROUNDWATER FLOW DIRECTION
(7.58)	POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)
(DRY)	NO WATER ENCOUNTERED IN THIS WELL
(NM)	NOT MEASURED

0 40 80
APPROXIMATE SCALE IN FEET

DRAWN BY CK	DATE 5/22/08	SHALLOW GROUNDWATER FLOW UST SITE 1120 DECEMBER 13, 2007 OUTLYING LANDING FIELD BRONSON PENSACOLA, FLORIDA	CONTRACT NO. 0055
CHECKED BY	DATE		OWNER NO.
REVISED BY BH	DATE 8/28/08		APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV. 1

NAVFAC

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

SAR addendum report recommended that monitored natural attenuation (NA) was a suitable course of action for the site (TtNUS, May 2001). On August 8, 2001, FDEP issued a technical review letter agreeing with the recommendation and requesting a Monitoring Only Plan (MOP) proposal for the site. On December 12, 2001, TtNUS submitted to FDEP the MOP proposal for Site 1120. On April 2, 2002, the FDEP MOP Approval Order, that outlined the requirements for NA monitoring at the site, was issued. TtNUS personnel conducted the first and second quarterly groundwater monitoring events in April 2002 and July 2002, respectively. Data collected during the second quarterly groundwater monitoring event indicated that concentrations of contaminants of concern (COCs) in the groundwater exceeded FDEP site-specific action levels. A confirmation sampling event was completed in September 2002, which confirmed the exceedance. Based on these results, TtNUS recommended that an Enhanced Natural Attenuation Treatability Study using Oxygen-Release Compound (ORC®) be completed at UST Site 1120.

The initial Treatability Study at the site was started in June 2003 and included a baseline sampling event (June 24 through 26, 2003), the ORC® injection event (July 13 to 19, 2003) and four quarters of post-injection groundwater sampling of 20 monitoring wells in September 2003, December 2003, March 2004, and June 2004. The site was scheduled for additional quarterly groundwater sampling in September 2004; however, the landfall of Hurricane Ivan on September 16, 2004 in the Pensacola area restricted site access and delayed all proposed work until March 2005. The quarterly sampling schedule then resumed with sampling events completed on March 2005, June 2005, and October 2005.

TtNUS completed the seventh quarterly groundwater monitoring event at Site 1120 on October 25 and 26, 2005 and submitted a letter report summarizing the results of the groundwater monitoring (TtNUS, February 2006). The analytical results indicated that the concentration of 2-methylnaphthalene [210 micrograms per liter (µg/L)] in monitoring well MW-14R exceeded the Natural Attenuation Action Levels of 200 µg/L.

When an exceedance of action levels is determined, FDEP requires that the monitoring well be resampled for confirmation and if the concentration is confirmed FDEP requires that a proposal be submitted including one of three options. The options include:

- Perform a supplemental site assessment and submit a supplemental site assessment report
- Continue the implementation of the approved NA monitoring plan
- Prepare and submit a Remedial Action Plan.

However, based on the review of the historic analytical data and collected NA parameters, TtNUS recommended in the Seventh Quarterly Groundwater Monitoring Letter Report (TtNUS, February 2006)

that an additional injection event be completed to enhance bioremediation of the groundwater surrounding monitoring wells MW-14R and MW-25.

A Treatability Study Work Plan for the proposed work was submitted (TtNUS, August 2007). During the preparation of the work plan, it was determined that enhanced biodegradation had limited effectiveness in the area of these wells [concentrations of polynuclear aromatic hydrocarbons (PAHs) in wells MW-14R and MW-25 exceeded the pre-injection concentrations]; therefore, a different technology, chemical oxidation, was recommended for the Treatability Study.

TtNUS installed additional groundwater monitoring wells in December 2007 to supplement the existing monitoring well network (both shallow and deep monitoring wells) and a round of baseline groundwater monitoring and sampling was conducted. In a letter report that documented the results of the December 2007 sampling (TtNUS, March 2008), it was recommended that the Treatability Study Work Plan (TtNUS, August 2007) be implemented with modifications to the proposed injection area and amount of chemical oxidant to be injected. In addition, TtNUS would complete quarterly sampling for a period of one year as per the Work Plan.

Subsequent to the March 12, 2008, letter, representatives of TtNUS and Naval Facilities Engineering Command, Southeast (NAVFAC SE) decided to pursue ***No Further Action*** at Site 1120 and submit a Risk-Based Closure Request.

1.2 PHYSICAL SETTING

Conditions at Site 1120 have been documented in historical site documents. This section of the report summarizes key information to the risk analysis.

1.2.1 Facility and Site Setting

NAS Pensacola is located south of the city of Pensacola (northwest Florida) on a peninsula on the western shore of Pensacola Bay. OLF Bronson is located northwest of NAS Pensacola about 1 mile from the Alabama State Line and 5 miles west of the city of Pensacola (Figure 1-1). OLF Bronson consists of approximately 950 acres of grassy areas and forest on the eastern shore of Perdido Bay and is now known as the Blue Angels Recreation Park (currently used for recreational purposes). The areas south, east, and north of the facility are undeveloped with the exception of some residential properties along U.S. Highway 98 and Perdido Bay (0.5 miles north of the facility).

Site 1120 is located on OLF Bronson southwest of the remains of Building 1120 (former boiler room). Dense woods are located north, east, and west of Site 1120 and a dirt road running east to west is

located south of the site. The site is an open, grassy area with the remains (concrete slab) of Building 1120 on the site.

1.2.2 Land Use

OLF Bronson, or Blue Angels Recreational Area, is now used for recreational purposes. A disc golf course and a paint ball range are now located near Site 1120.

1.2.3 Groundwater and Surface Water Features

Site 1120 is relatively flat, with a slight slope to the west. Soil at the site consists of a 2-inch layer of sandy loam at the surface and fine to medium sand interspersed with traces of silt and clay below the top layer. Medium sand with traces of coarse sand and silt can be found at lower depths [20 feet below ground surface (bgs)].

Groundwater elevations, as measured December 14, 2007, ranged from 6.52 feet to 7.98 feet. Groundwater contours developed from these elevations show that groundwater flows to the southwest (Figure 1-2).

The nearest surface water body is Perdido Bay, which eventually connects with the Gulf of Mexico.

1.3 REPORT ORGANIZATION

Section 1.0, Introduction, provides a summary of the site history and physical setting, including site setting, land use, and groundwater and surface water features.

Section 2.0, Data Evaluation and Constituents of Potential Concern Selection, summarizes the soil and groundwater data collected at the site and the results of screening comparisons to soil cleanup target levels (SCTLs) and groundwater cleanup target levels (GCTLs).

Section 3.0, Exposure Assessment, provides the results of the risk assessment performed for Site 1120.

Section 4.0, Conclusions and Recommendations, provides the conclusion of the evaluation of the data and risk assessment and identifies the recommendations for how to proceed with the site.

2.0 DATA EVALUATION AND CONSTITUENTS OF CONCERN SELECTION

The data used to evaluate potential risks for Site 1120 have been presented in the SAR addendum submitted in May 2001 (soil) (TtNUS, May 2001), and the Baseline Sampling Letter Report submitted in March 2008 (groundwater) (TtNUS, March 2008). The specific soil and groundwater data used in this evaluation is included in Tables 2-1 through 2-3.

2.1 SOIL

In response to comments received from FDEP on the SAR, three soil borings (OLFB20SB01, OLFB20SB02, and OLFB20SB03) were installed in June 2000 (Figure 2-1). The soil borings were advanced from the ground surface to 14 feet bgs and were sampled continuously at 2-foot intervals. The intervals submitted for chemical analysis were selected based on field screening results, field observations, and/or proximity to the seasonal high groundwater level. Two subsurface soil samples were collected from each soil boring (one duplicate sample was also collected) to provide data on site conditions following the removal of the USTs in 1994. Each sample was analyzed for volatile organic compounds (VOCs), PAHs, and total petroleum hydrocarbons (TPH).

Table 2-1 provides a summary of the positive detections found in the soils samples. The complete data set is provided in Appendix B. Table 2-1 also provides the SCTLs for direct exposure (residential and industrial) and for indirect exposure (leachability-based).

Only one VOC (toluene) was detected in the soil samples and it was detected in four of the six samples collected. Ten PAHs were detected in one sample (OLFB20SB03-1012) only. They were not detected in the field duplicate collected at this same location, indicating the heterogeneous nature of the soil at the site. TPH were detected in five of the six samples collected.

2.1.1 Soil Screening Comparison with Direct Exposure SCTLs

The comparison of the positive detections in the soil samples with the direct exposure SCTLs (residential and industrial) indicates that only benzo(a)pyrene was detected at a concentration that exceeds a residential SCTL. None of the chemicals detected exceed an industrial SCTL.

Concentrations of other carcinogenic PAHs are converted to an equivalent concentration of benzo(a)pyrene to evaluate carcinogenic effects from exposure to PAHs. The benzo(a)pyrene equivalent concentration is shown in Table 2-1 and comparison of this concentration to the SCTLs indicate that the

TABLE 2-1

SUMMARY OF DETECTED CONCENTRATIONS - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 1 OF 2

SAMPLE NUMBER	OLFB20SB01-0406	OLFB20SB01-1214	OLFB20SB02-0406	OLFB20SB02-1214	OLFB20SB03-0810	OLFB20SB03-1012
LOCATION	OLFB20SB01	OLFB20SB01	OLFB20SB02	OLFB20SB02	OLFB20SB03	OLFB20SB03
SAMPLE DATE	20000601	20000601	20000601	20000601	20000601	20000601
DEPTH RANGE (Feet)	4 - 6	12 - 14	4 - 6	12 - 14	8 - 10	10 - 12
Volatile Organics (mg/kg)						
TOLUENE	0.0052 U	0.0014 J	0.0015 J	0.0058 U	0.0012 J	0.0057 U
Semivolatile Organics (mg/kg)						
BENZO(A)ANTHRACENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	0.123
BENZO(A)PYRENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	**0.108**
BENZO(B)FLUORANTHENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	0.136
BENZO(G,H,I)PERYLENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	0.091
BENZO(K)FLUORANTHENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	0.0782
CHRYSENE	0.34 U	0.34 U	0.35 U	0.35 U	0.35 U	0.136 J
FLUORANTHENE	0.34 U	0.34 U	0.35 U	0.35 U	0.35 U	0.288 J
INDENO(1,2,3-CD)PYRENE	0.068 U	0.068 U	0.07 U	0.07 U	0.069 U	0.142
PHENANTHRENE	0.34 U	0.34 U	0.35 U	0.35 U	0.35 U	0.12 J
PYRENE	0.34 U	0.34 U	0.35 U	0.35 U	0.35 U	0.186 J
B(a)P EQUIVALENT	ND	ND	ND	ND	ND	**0.18**[3]
Petroleum Hydrocarbons (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	70.3	47.2	12.5	8.8 U	16.6	22

TABLE 2-1

SUMMARY OF DETECTED CONCENTRATIONS - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 2 OF 2

SAMPLE NUMBER	OLFB20SB03-1012-AVG	OLFB20SB03-1012-D	HUMAN HEALTH RISK SCREENING SOIL CLEANUP TARGET LEVEL[1]		
LOCATION	OLFB20SB03	OLFB20SB03			
SAMPLE DATE	20000601	20000601	Residential	Industrial	Leachability
DEPTH RANGE (Feet)	10 - 12	10 - 12			
Volatile Organics (mg/kg)					
TOLUENE	0.0012 J	0.0012 J	7500	60000	0.5
Semivolatile Organics (mg/kg)					
BENZO(A)ANTHRACENE	0.07875	0.069 U	[2]	[2]	0.8
BENZO(A)PYRENE	0.07125	0.069 U	**0.1**	0.7	8
BENZO(B)FLUORANTHENE	0.08525	0.069 U	[2]	[2]	2.4
BENZO(G,H,I)PERYLENE	0.06275	0.069 U	2500	52000	32000
BENZO(K)FLUORANTHENE	0.05635	0.069 U	[2]	[2]	24
CHRYSENE	0.136 J	0.35 U	[2]	[2]	77
FLUORANTHENE	0.288 J	0.35 U	3200	59000	1200
INDENO(1,2,3-CD)PYRENE	0.08825	0.069 U	[2]	[2]	6.6
PHENANTHRENE	0.12 J	0.35 U	2200	36000	250
PYRENE	0.186 J	0.35 U	2400	45000	880
B(a)P EQUIVALENT	**0.13[3]**	ND	**0.1**	0.7	8
Petroleum Hydrocarbons (mg/kg)					
TOTAL PETROLEUM HYDROCARBONS	21.3	20.6	460	2700	340

Shaded cells indicate that the specified criterion has been exceeded.

Footnotes:
1 Soil Cleanup Target levels (SCTLs) for Chapter 62-777, F.A. C. FDEP, April 2005.
2 Individual SCTLs are not available for these carcinogenic compounds. The concentrations for these compounds are converted to benzo(a)pyrene equivalents and totaled. The resulting benzo(a)pyrene equivalent concentration is compared to the SCTLs for benzo(a)pyrene.
3 The calculated B(a)P equivalent for this sample includes 1/2 the detection limit for dibenzo(a,h)anthracene.

J = estimated concentration
U = non-detect value
mg/kg = milligrams per kilogram
ND = Not Detected
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 1 OF 7

WELL NAME		Cont. Wells SSAL(2) (µg/L)	Peri. Wells SSAL(2) (µg/L)	MW-01								MW-02								MW-04							
FDEP WELL DESIGNATION												Contaminated well								Contaminated well							
SAMPLE ID	GCTL(1) (µg/L)			BRN-1120-MW01								BRN-1120-MW02								BRN-1120-MW04							
SAMPLING EVENT				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
COLLECTION DATE				06/24/03	09/25/03	12/10/03	NS	NS	03/02/05	NS	NS	06/24/03	09/25/03	12/10/03	03/11/04	06/08/04	03/02/05	06/07/05	10/25/05	06/24/03	09/25/03	12/10/03	03/11/04	06/08/04	03/02/05	06/07/05	NS
VOCs (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	NS	NS	1 U	NS	NS	1 U	1 U	0.09 J	1 U	1 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NS
ETHYLBENZENE	30	300	30	1 U	1 U	1 U	NS	NS	1 U	NS	NS	0.5 J	1 U	1 U	1 U	1 U	1 U	1 U	0.2 U	14	1 U	6	1 U	3	1 U	1 U	NS
M+P-XYLENES	NC	NC	NC	1 U	2 U	2 U	NS	NS	NR	NS	NS	1 U	2 U	2 U	2 U	2 U	NR	NR	0.5 U	28	2 U	12	2 U	3	NR	NR	NS
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	NS	NS	NR	NS	NS	0.5 J	1 U	1 U	1 U	1 U	NR	NR	0.3 U	1 U	1 U	1 U	1 U	1 U	NR	NR	NS
TOLUENE	40	NC	NC	1 U	1 U	1 U	NS	NS	1 U	NS	NS	1 U	1 U	0.3 J	1 U	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NS
TOTAL XYLENES	20	200	20	1 U	3 U	3 U	NS	NS	3 U	NS	NS	2	3 U	3 U	3 U	3 U	3 U	3 U	0.8 U	28	3 U	12	3 U	3	3 U	3 U	NS
PAHs (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	5.9	0.2 U	1.4	0.18 J	5.2	3.1	0.2 U	15	380	0.2 U	36	0.2 U	18	0.2 U	0.2 U	NS
2-METHYLNAPHTHALENE	28	200	20	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	4.9	0.2 U	1.2	0.22	4.9	3.1	0.2 U	14	220	0.2 U	52	0.2 U	21	0.2 U	0.2 U	NS
ACENAPHTHENE	20	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	110 U	0.2 U	7.7 U	0.2 U	0.3	0.2 U	0.2 U	NS
ACENAPHTHYLENE	210	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
BENZO(A)ANTHRACENE	0.05	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
CHRYSENE	4.8	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
FLUORANTHENE	280	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
FLUORENE	280	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.092 J	0.2 U	0.2 U	0.2 J	110 U	0.2 U	7.7 U	0.2 U	0.52	0.2 U	0.2 U	NS
NAPHTHALENE	14	200	20	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	3	0.2 U	1.3	0.54	2.6	1.2	0.2 U	2	440	0.2 U	42	0.2 U	20	0.2 U	0.2 U	NS
PHENANTHRENE	210	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	110 U	0.2 U	7.7 U	0.2 U	0.26	0.2 U	0.2 U	NS
PYRENE	210	NC	NC	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	NS	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U	110 U	0.2 U	7.7 U	0.2 U	0.2 U	0.2 U	0.2 U	NS
TRPH (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	500 U	290 J	530 U	NS	NS	320 J	NS	NS	1600	500 U	1700 U	500 U	670 J	680 J	420 J	560 U	3200	720	1800 U	290 J	650	1700 U	470 J	NS

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 2 OF 7

WELL NAME		Cont.	Peri.	MW-05R								MW-07								MW-08							
FDEP WELL DESIGNATION		Wells	Wells	Contaminated well																							
SAMPLE ID	GCTL(1)	SSAL(2)	SSAL(2)	BRN-1120-MW05R								BRN-1120-MW07								BRN-1120-MW08							
SAMPLING EVENT	(µg/L)	(µg/L)	(µg/L)	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
COLLECTION DATE				06/24/03	09/25/03	12/10/03	03/11/04	06/08/04	03/02/05	06/07/05	10/26/05	06/25/03	09/26/03	12/11/03	03/11/04	06/08/04	03/03/05	NS	NS	NS	09/25/03	NS	03/11/04	NS	NS	NS	NS
VOCs(3) (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.3 U	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS	NS	1 U	NS	1 U	NS	NS	NS	NS
ETHYLBENZENE	30	300	30	0.3 J	1 U	10	1 U	12	0.96 J	1.0 U	6	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS	NS	1 U	NS	1 U	NS	NS	NS	NS
M+P-XYLENES	NC	NC	NC	1 U	2 U	30	2 U	28	NR	NR	16	1 U	2 U	2 U	2 U	2 U	NR	NS	NS	NS	2 U	NS	2 U	NS	NS	NS	NS
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	1 U	0.6 J	NR	NR	0.3 U	1 U	1 U	1 U	1 U	1 U	NR	NS	NS	NS	1 U	NS	1 U	NS	NS	NS	NS
TOLUENE	40	NC	NC	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.2 U	1 U	1 U	1 U	1 U	1 U	0.43 J	NS	NS	NS	1 U	NS	1 U	NS	NS	NS	NS
TOTAL XYLENES	20	200	20	1 U	3 U	30	3 U	28	2.8 J	3.0 U	16	1 U	3 U	3 U	3 U	3 U	3 U	NS	NS	NS	3 U	NS	3 U	NS	NS	NS	NS
PAHs(4) (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	2.2	0.2 U	34	0.2 U	37	0.31	0.2 U	16	0.2 U	0.2 U	0.37	0.094 J	0.84	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
2-METHYLNAPHTHALENE	28	200	20	1.3	0.2 U	43	0.2 U	44	0.27	0.2 U	11	0.2 U	0.2 U	0.25	0.098 J	0.64	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
ACENAPHTHENE	20	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.47	0.2 U	.15 J	0.1 J	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
ACENAPHTHYLENE	210	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.051	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
BENZO(A)ANTHRACENE	0.05	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
CHRYSENE	4.8	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
FLUORANTHENE	280	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
FLUORENE	280	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.85	0.2 U	0.2 U	0.1 J	0.2 U	0.2 U	0.11	0.2 U	0.3	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
NAPHTHALENE	14	200	20	2.1	0.2 U	48	0.2 U	46	2.0	0.2 U	27	0.2 U	0.2 U	0.2 U	0.2 U	0.12 J	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
PHENANTHRENE	210	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.38	0.2 U	0.2 U	0.08 U	0.2 U	0.2 U	0.2 U	0.2 U	0.18 J	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
PYRENE	210	NC	NC	0.2 U	0.2 U	7.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	NS	NS	NS	0.2 U	NS	0.2 U	NS	NS	NS	NS
TRPH(5) (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	620	890	1800 U	350 J	1200	1100 J	1300 J	570	500 U	500 U	500 U	500 U	310 J	1700 U	NS	NS	NS	500 U	NS	500 U	NS	NS	NS	NS

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 3 OF 7

WELL NAME				MW-13R Contaminated well BRN-1120-MW13R								MW-14R Contaminated well BRN-1120-MW14R								MW-16R Contaminated well BRN-1120-MW16R							
FDEP WELL DESIGNATION	GCTL(1) (µg/L)	Cont. Wells SSAL(2) (µg/L)	Peri. Wells SSAL(2) (µg/L)																								
SAMPLE ID				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
SAMPLING EVENT																											
COLLECTION DATE				06/25/03	09/25/03	12/10/03	03/11/04	NS	NS	06/07/05	10/25/05	06/25/03	09/25/03	12/10/03	03/10/04	06/07/04	03/02/05	06/08/05	10/25/05	06/25/03	09/24/03	12/10/03	03/10/04	06/07/04	03/03/05	06/08/05	10/26/05
VOCs(3) (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	1 U	NS	NS	1.0 U	0.3 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.3 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.3 U
ETHYLBENZENE	30	300	30	1 U	1 U	1 U	1 U	NS	NS	1.0 U	0.2 U	16	3	9	23	11	5.5	1.0 U	7	1 U	0.7 J	1 U	1 U	1 U	1 U	2.9	0.2 U
M+P-XYLENES	NC	NC	NC	1 U	2 U	2 U	2 U	NS	NS	NR	0.5 U	32	5	12	51	10	NR	NR	5	1 U	3	2 U	2 U	2 U	NR	NR	0.5 U
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	1 U	NS	NS	NR	0.3 U	1 U	1 U	1 U	1 U	0.6 J	NR	NR	0.5 J	1 U	1 U	1 U	1 U	1 U	NR	NR	0.3 U
TOLUENE	40	NC	NC	1 U	1 U	1 U	1 U	NS	NS	1.0 U	0.2 U	1 U	1 U	1 U	1 U	1 U	0.33 J	1.0 U	0.2 U	1 U	1 U	1 U	1 U	1 U	0.34 J	1.0 U	0.2 U
TOTAL XYLENES	20	200	20	1 U	3 U	3 U	3 U	NS	NS	3.0 U	0.8 U	32	5	12	51	10	10	3.0 U	6	1 U	3	3 U	3 U	3 U	3 U	9	0.8 U
PAHs(4) (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.1 U	160	76	130	160	140	120	0.75	190	2.3	5	13	0.099 J	5.6	1.4	11	14
2-METHYLNAPHTHALENE	28	200	20	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.06 U	150	97	200	210	200	140	1.1	210	5.6	6.2	23	0.2 J	7	2.4	17	20
ACENAPHTHENE	20	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.09 U	44 U	7.5 U	19 U	2.6	1.5	1.7	0.2 U	3	0.97 U	0.75 U	0.98 J	0.2 U	0.19 J	0.2 U	0.17 J	0.09 U
ACENAPHTHYLENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.04 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U
BENZO(A)ANTHRACENE	0.05	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.08 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.1 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
CHRYSENE	4.8	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.05 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U
FLUORANTHENE	280	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.07 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U
FLUORENE	280	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.06 U	44 U	2.5 J	19 U	4.1 E	2.9	3.4	0.2 U	4	0.97 U	0.75 U	1.1 J	0.2 U	0.48	0.079 J	0.26	1
NAPHTHALENE	14	200	20	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.05 U	52	41	98	160	100	62	0.46	82	0.97 U	1.4	1.9 U	0.2 U	0.2	0.2 U	12	0.5
PHENANTHRENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.08 U	44 U	7.5 U	19 U	2.2	2.2	2.6	0.2 U	3	0.97 U	0.75 U	1.9 U	0.2 U	0.12 J	0.057 J	0.10 J	0.4
PYRENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	NS	NS	0.2 U	0.09 U	44 U	7.5 U	19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	0.97 U	0.75 U	1.9 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U
TRPH(5) (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	510 U	500 U	280 J	500 U	NS	NS	1700 U	220 U	3800	4600	4000	2500	2200	5100	1700 U	2600	400 J	360 J	1100 U	500 U	420 J	1700 U	450 J	780

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 4 OF 7

WELL NAME		Cont. Wells	Peri. Wells	MW-17								MW-18								MW-24 Contaminated well							
FDEP WELL DESIGNATION	GCTL(1)	SSAL(2)	SSAL(2)	BRN-1120-MW17								BRN-1120-MW18								BRN-1120-MW24							
SAMPLE ID	(µg/L)	(µg/L)	(µg/L)																								
SAMPLING EVENT				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
COLLECTION DATE				06/26/03	09/26/03	12/11/03	03/11/04	NS	NS	NS	NS	06/26/03	09/26/03	12/11/03	03/10/04	06/08/04	03/03/05	NS	NS	06/25/03	09/24/03	12/10/03	03/10/04	06/07/04	03/03/05	06/07/05	10/26/05
VOCs(3) (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	1 U	NS	NS	NS	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.3 U
ETHYLBENZENE	30	300	30	1 U	1 U	1 U	1 U	NS	NS	NS	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.2 U
M+P-XYLENES	NC	NC	NC	1 U	2 U	2 U	2 U	NS	NS	NS	NS	1 U	2 U	2 U	2 U	2 U	NR	NS	NS	1 U	2 U	2 U	2 U	2 U	NR	NR	0.5 U
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	1 U	NS	NS	NS	NS	1 U	1 U	1 U	1 U	1 U	NR	NS	NS	1 U	1 U	1 U	1 U	1 U	NR	NR	0.3 U
TOLUENE	40	NC	NC	1 U	1 U	1 U	1 U	NS	NS	NS	NS	1 U	1 U	1 U	1 U	1 U	0.64 J	NS	NS	1 U	1 U	1 U	1 U	1 U	0.37 J	1.0 U	0.2 U
TOTAL XYLENES	20	200	20	1 U	3 U	3 U	3 U	NS	NS	NS	NS	1 U	3 U	3 U	3 U	3 U	3 U	NS	NS	1 U	3 U	3 U	3 U	3 U	3 U	3.0 U	0.8 U
PAHs(4) (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	0.11 J	0.2 U	0.096	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	6.7	0.2 U	26	4.2	8.6	3.6	0.075 J	3
2-METHYLNAPHTHALENE	28	200	20	0.092 J	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	5.9	0.12 J	50	6	16	17	0.11 J	17
ACENAPHTHENE	20	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.17 J	7.5 U	0.3	0.36	0.4	0.2 U	0.8
ACENAPHTHYLENE	210	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.74 J	0.2 U	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U
BENZO(A)ANTHRACENE	0.05	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.13 J	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.16 J	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
CHRYSENE	4.8	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.2 U	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U
FLUORANTHENE	280	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.2 U	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U
FLUORENE	280	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.7 J	0.2 U	2.9 J	0.39	1.1	0.86	0.2 U	1
NAPHTHALENE	14	200	20	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.13 J	7.5 U	0.08 J	0.36	0.28	0.2 U	0.8
PHENANTHRENE	210	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.2 U	7.5 U	0.17 J	0.44	0.88	0.2 U	0.3
PYRENE	210	NC	NC	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	0.22 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	1 U	0.19 J	7.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U
TRPH(5) (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	400 J	500 U	310 U	500 U	NS	NS	NS	NS	1300	500 U	570 U	500 U	500 U	1700 U	NS	NS	1200	500 U	2200 U	350 J	690	1200 J	1700 U	780

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 5 OF 7

WELL NAME				MW-25								MW-26								MW-27							
FDEP WELL DESIGNATION				Contaminated well								Contaminated well															
SAMPLE ID	GCTL(1) (µg/L)	Cont. Wells SSAL(2) (µg/L)	Peri. Wells SSAL(2) (µg/L)	BRN-1120-MW25								BRN-1120-MW26								BRN-1120-MW27							
SAMPLING EVENT				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
COLLECTION DATE				06/25/03	09/25/03	12/11/03	03/10/04	NS	NS	06/08/05	10/26/05	06/26/03	09/24/03	12/11/03	03/10/04	06/07/04	NS	06/08/05	NS	06/26/03	09/25/03	12/10/03	03/10/04	06/08/04	03/03/05	NS	NS
VOCs(3) (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	1 U	NS	NS	1.0 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NS	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS
ETHYLBENZENE	30	300	30	1	1 U	0.8 U	0.9 J	NS	NS	1.0 U	0.3 J	1 U	1 U	1 U	1 U	1 U	NS	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS
M+P-XYLENES	NC	NC	NC	1 U	2 U	0.4 J	2	NS	NS	NR	0.5 U	1 U	2 U	2 U	2 U	2 U	NS	NR	NS	1 U	2 U	2 U	2 U	2 U	NR	NS	NS
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	1 U	NS	NS	NR	0.3 U	1 U	1 U	1 U	1 U	1 U	NS	NR	NS	1 U	1 U	1 U	1 U	1 U	NR	NS	NS
TOLUENE	40	NC	NC	1 U	1 U	1 U	1 U	NS	NS	1.0 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NS	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS
TOTAL XYLENES	20	200	20	1 U	3 U	3 U	2 J	NS	NS	3.0 U	0.8 U	1 U	3 U	3 U	3 U	3 U	NS	3.0 U	NS	1 U	3 U	3 U	3 U	3 U	3 U	NS	NS
PAHs(4) (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	7.3	0.2 U	17	14	NS	NS	0.2 U	34	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
2-METHYLNAPHTHALENE	28	200	20	20	0.11 J	56	18	NS	NS	0.2 U	56	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
ACENAPHTHENE	20	NC	NC	1.9 U	0.2 U	7.7 U	0.24	NS	NS	0.2 U	0.09 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
ACENAPHTHYLENE	210	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.04 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
BENZO(A)ANTHRACENE	0.05	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.08 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.17 J	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
BENZO(K)FLUORANTHENE	0.5	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.1 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
CHRYSENE	4.8	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.05 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.14 J	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
FLUORANTHENE	280	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.07 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.17 J	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
FLUORENE	280	NC	NC	1.9 U	0.2 U	7.7 U	0.36	NS	NS	0.2 U	2	0.21 U	0.2 U	0.2 U	0.2 U	0.17 J	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
NAPHTHALENE	14	200	20	6	0.2 U	16	6.4	NS	NS	0.2 U	9	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
PHENANTHRENE	210	NC	NC	1.9 U	0.2 U	7.7 U	0.11 J	NS	NS	0.2 U	0.8	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.077 J	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
PYRENE	210	NC	NC	1.9 U	0.2 U	7.7 U	0.2 U	NS	NS	0.2 U	0.09 U	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	0.2 U	NS	0.2 U	0.22	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
TRPH(5) (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	950	500 U	1300 U	450 J	NS	NS	1700 U	700	520 U	500 U	500 U	500 U	500 U	NS	1700 U	NS	500 U	500 U	330 U	500 U	500 U	1700 J	NS	NS

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 6 OF 7

WELL NAME	GCTL(1) (µg/L)	Cont. Wells SSAL(2) (µg/L)	Peri. Wells SSAL(2) (µg/L)	MW-28								MW-29								MW-30							
FDEP WELL DESIGNATION				Perimeter Well								Perimeter Well								Perimeter Well							
SAMPLE ID				BRN-1120-MW28								BRN-1120-MW29								OLFB1120MW30							
SAMPLING EVENT				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
COLLECTION DATE				06/26/03	09/25/03	12/10/03	03/10/04	06/08/04	03/03/05	06/07/05	10/25/05	NS	09/25/03	12/10/03	03/10/04	06/08/04	NS	NS	10/25/05	NS	NS	NS	NS	06/07/04	NS	NS	10/26/05
VOCs(3) (µg/L)																											
BENZENE	1	NC	NC	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.3 U	NS	1 U	1 U	1 U	1 U	NS	NS	0.3 U	NS	NS	NS	NS	1 U	NS	NS	0.3 U
ETHYLBENZENE	30	300	30	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	0.2 U	NS	1 U	1 U	0.3 J	0.4 J	NS	NS	0.2 U	NS	NS	NS	NS	1 U	NS	NS	0.2 U
M+P-XYLENES	NC	NC	NC	1 U	2 U	2 U	2 U	2 U	NR	NR	0.5 U	NS	2 U	2 U	2 U	2 U	NS	NS	0.5 U	NS	NS	NS	NS	2 U	NS	NS	0.5 U
O-XYLENE	NC	NC	NC	1 U	1 U	1 U	1 U	1 U	NR	NR	0.3 U	NS	1 U	1 U	1 U	1 U	NS	NS	0.3 U	NS	NS	NS	NS	1 U	NS	NS	0.3 U
TOLUENE	40	NC	NC	1 U	1 U	1 U	1 U	1 U	0.30 J	1.0 U	0.2 U	NS	1 U	1 U	0.2 J	1 U	NS	NS	0.2 U	NS	NS	NS	NS	1 U	NS	NS	0.2 U
TOTAL XYLENES	20	200	20	1 U	3 U	3 U	3 U	3 U	3 U	3.0 U	0.8 U	NS	3 U	3 U	3 U	3 U	NS	NS	0.8 U	NS	NS	NS	NS	3 U	NS	NS	0.8 U
PAHs(4) (µg/L)																											
1-METHYLNAPHTHALENE	28	200	20	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U	NS	0.2 U	0.2 U	0.2 U	0.085 J	NS	NS	0.09 U	NS	NS	NS	NS	0.33	NS	NS	0.09 U
2-METHYLNAPHTHALENE	28	200	20	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.06 U	NS	0.2 U	1.2	0.97	2.7	NS	NS	0.06 U	NS	NS	NS	NS	3.6	NS	NS	1
ACENAPHTHENE	20	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	NS	0.2 U	0.2 U	0.12 J	0.21	NS	NS	0.08 U	NS	NS	NS	NS	0.34	NS	NS	0.08 U
ACENAPHTHYLENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.04 U	NS	NS	NS	NS	0.2 U	NS	NS	0.04 U
BENZO(A)ANTHRACENE	0.05	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.08 U	NS	NS	NS	NS	0.2 U	NS	NS	0.08 U
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.09 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.09 U	NS	NS	NS	NS	0.2 U	NS	NS	0.09 U
CHRYSENE	4.8	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.05 U	NS	NS	NS	NS	0.2 U	NS	NS	0.05 U
FLUORANTHENE	280	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.07 U	NS	NS	NS	NS	0.2 U	NS	NS	0.07 U
FLUORENE	280	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.06 U	NS	0.2 U	0.11 J	0.19 J	0.38	NS	NS	0.06 U	NS	NS	NS	NS	1	NS	NS	0.5
NAPHTHALENE	14	200	20	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.05 U	NS	0.2 U	0.12 J	0.52	1.6	NS	NS	0.05 U	NS	NS	NS	NS	0.29	NS	NS	0.2
PHENANTHRENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	NS	0.2 U	0.2 U	0.1 J	0.086 J	NS	NS	0.08 U	NS	NS	NS	NS	0.43	NS	NS	0.3
PYRENE	210	NC	NC	0.21 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.08 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	0.08 U	NS	NS	NS	NS	0.2 U	NS	NS	0.08 U
TRPH(5) (µg/L)																											
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	500 U	500 U	340 U	500 U	500 U	1700 J	1700 U	210 U	NS	500 U	500 U	500 U	300 J	NS	NS	220 U	NS	NS	NS	NS	490	NS	NS	540

TABLE 2-2

SUMMARY OF GROUNDWATER MONITORING DATA
UST SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 7 OF 7

WELL NAME		Cont. Wells SSAL(2) (µg/L)	Peri. Wells SSAL(2) (µg/L)	MW-32								MW-35							
FDEP WELL DESIGNATION	GCTL(1) (µg/L)			BRN-1120-MW32								BRN-1120-MW35							
SAMPLE ID				Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q	Baseline	1Q	2Q	3Q	4Q	5Q	6Q	7Q
SAMPLING EVENT				06/26/03	NS	NS	NS	NS	03/03/05	06/07/05	NS	06/26/03	09/25/03	12/10/03	03/10/04	06/07/04	03/02/05	NS	NS
COLLECTION DATE																			
VOCs(3) (µg/L)																			
BENZENE	1	NC	NC	1 U	NS	NS	NS	NS	1 U	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS
ETHYLBENZENE	30	300	30	1 U	NS	NS	NS	NS	1 U	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	1 U	NS	NS
M+P-XYLENES	NC	NC	NC	1 U	NS	NS	NS	NS	NR	NR	NS	1 U	2 U	2 U	2 U	2 U	NR	NS	NS
O-XYLENE	NC	NC	NC	1 U	NS	NS	NS	NS	NR	NR	NS	1 U	1 U	1 U	1 U	1 U	NR	NS	NS
TOLUENE	40	NC	NC	1 U	NS	NS	NS	NS	0.30 J	1.0 U	NS	1 U	1 U	1 U	1 U	1 U	0.27 J	NS	NS
TOTAL XYLENES	20	200	20	1 U	NS	NS	NS	NS	3 U	3.0 U	NS	1 U	3 U	3 U	3 U	3 U	3 U	NS	NS
PAHs(4) (µg/L)																			
1-METHYLNAPHTHALENE	28	200	20	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
2-METHYLNAPHTHALENE	28	200	20	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
ACENAPHTHENE	20	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
ACENAPHTHYLENE	210	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
BENZO(A)ANTHRACENE	0.05	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
BENZO(K)FLUORANTHENE	0.5	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
CHRYSENE	4.8	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
FLUORANTHENE	280	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
FLUORENE	280	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
NAPHTHALENE	14	200	20	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
PHENANTHRENE	210	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
PYRENE	210	NC	NC	0.2 U	NS	NS	NS	NS	0.2 U	0.2 U	NS	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS
TRPH(5) (µg/L)																			
TOTAL PETROLEUM HYDROCARBONS	5000	50000	5000	500 U	NS	NS	NS	NS	1700 J	1700 U	NS	500 U	500 U	350 U	500 U	500 U	1700J	NS	NS

Notes:

440 Exceeds GCTL

440 Exceeds GCTL and NADSC

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, FAC.
[2] Site-specific Natural Attenuation Action Levels FDEP April 2, 2002.
J = Estimated concentration
U = non-detect value
µg/L = micrograms per liter
NC = No Criteria
FAC = Florida Administrative Code
NS = Not sampled
NR = Not reported

TABLE 2-3

SUMMARY OF GROUNDWATER DATA - DECEMBER 2007
SITE 1120 - OLF BRONSON
PENSACOLA, FLORIDA
PAGE 1 OF 2

WELL NAME	GCTL[1]	NADSC[2]	MW-5R	MW-7	MW-14R	MW-14R DUP	MW-16R	MW-24	MW-25	MW-27
SAMPLE ID			BRN-1120-MW05R	BRN-1120-MW07	BRN-1120-MW14R	BRN-1120-DUP01-1207	BRN-1120-MW16R	BRN-1120-MW24	BRN-1120-MW25	BRN-1120-MW27
SAMPLING EVENT			Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
COLLECTION DATE			12/13/07	12/13/07	12/14/07	12/14/07	12/13/07	12/13/07	12/13/07	12/13/07
VOCs (µg/L)										
CHLOROFORM	70	700	0.21U	0.58 J	0.21U	0.21U	0.39 J	1.6	0.26 J	3.3
ETHYLBENZENE	30	300	0.2 U	0.2 U	6	6.2	0.2 U	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	20	200	0.56 U	0.56 U	9.3	10.2	0.56 U	0.56 U	0.56 U	0.56 U
PAHs (µg/L)										
1-METHYLNAPHTHALENE	28	280	0.25 U	0.24 U	140	133	0.34 J	0.25 J	0.25 U	0.25 U
2-METHYLNAPHTHALENE	28	280	0.25 U	0.24 U	178	172	0.43 J	0.65 J	0.25 U	0.25 U
ACENAPHTHENE	20	200	0.5 U	0.49 U	2 U	2 U	0.5 U	0.49 U	0.5 U	0.5 U
FLUORENE	280	2800	0.25 U	0.24 U	4.8	4.7	0.25 U	0.24 U	0.25 U	0.25 U
NAPHTHALENE	14	140	0.25 U	0.24 U	77.5	73.9	0.25 U	0.24 U	0.25 U	0.25 U
PHENANTHRENE	210	2100	0.5 U	0.49 U	2.6 J	2.5 J	0.5 U	0.49 U	0.5 U	0.5 U
TRPH (mg/L)										
TOTAL PETROLEUM HYDROCARBONS	5000	50,000	1,113	170 U	6,960	6,100	170 U	206 J	170 U	180 U

TABLE 2-3

SUMMARY OF GROUNDWATER DATA - DECEMBER 2007
SITE 1120 - OLF BRONSON
PENSACOLA, FLORIDA
PAGE 2 OF 2

WELL NAME	GCTL[1]	NADSC[2]	MW-28	MW-29	MW-30	MW-36	MW-37	MW-38	MW-39	MW-40
SAMPLE ID			BRN-1120-MW28	BRN-1120-MW29	OLFB1120MW30	BRN-1120-MW32	BRN-1120-MW35	BRN-1120-MW35	BRN-1120-MW35	BRN-1120-MW35
SAMPLING EVENT			Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
COLLECTION DATE			12/14/07	12/14/07	12/14/07	12/13/07	12/13/07	12/13/07	12/13/07	12/13/07
VOCs (µg/L)										
CHLOROFORM	70	700	4.1	11.1	5.6	3.5	25.5	0.21U	0.21U	0.47 J
ETHYLBENZENE	30	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	20	200	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
PAHs (µg/L)										
1-METHYLNAPHTHALENE	28	280	0.25 U	0.25 U	1.2	0.25 U	0.24 U	0.24 U	0.24 U	12.8
2-METHYLNAPHTHALENE	28	280	0.25 U	0.25 U	2.4	0.25 U	0.24 U	0.69 J	0.24 U	17.2
ACENAPHTHENE	20	200	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U	0.49 U	0.54 J
FLUORENE	280	2800	0.25 U	0.25 U	0.48 J	0.25 U	0.24 U	0.24 U	0.24 U	1.5
NAPHTHALENE	14	140	0.25 U	0.25 U	0.26 J	0.25 U	0.24 U	0.36 J	0.24 U	0.96 J
PHENANTHRENE	210	2100	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U	0.49 U	1.1
TRPH (mg/L)										
TOTAL PETROLEUM HYDROCARBONS	5000	50,000	170 U	170 U	702	170 U	160 U	170 U	170 U	1,410

Shaded cells indicate that the specified criterion has been exceeded.
J = Estimated concentration
U = non-detect value
µg/L = micrograms per liter
mg/L = miligrams per liter
FAC = Florida Administrative Code

Footnotes:
1 Groundwater Cleanup Target Level as provided in Chapter 62-777, FAC.
2 Natural Attenuation Default source concentrations as provided in Chapter 62-770, FAC.

Rev. 1
09/03/08

ACAD: 0055GM10.dwg 05/22/08 CK PIT

N

MW-17
MW-27
MW-36
MW-18
FORMER LOCATION OF FUEL OIL STORAGE TANKS
DMW-34
MW-7
FORMER LOCATION OF BUTANE STORAGE TANK
MW-19
MW-13R
MW-3
MW-8
MW-2 (7.98)
EXISTING CONCRETE SLAB (FORMER BUILDING 1120-1)
MW-20
MW-37
MW-25
MW-9
MW-1 (NM)
MW-11
MW-15
MW-4R
SB03
MW-21
MW-5R
SB01
MW-28
DIRT ROAD
MW-6
MW-10
MW-26
MW-14R
DMW-35
SB02
MW-38
MW-16R
MW-12
MW-33
DMW-39
MW-22
MW-40
MW-29
MW-24
MW-23
MW-32
MW-30
MW-31

LEGEND:

MW-22	MONITORING WELL LOCATION AND DESIGNATION
DMW-35	DEEP MONITORING WELL LOCATION AND DESIGNATION
SB01	SOIL BORING LOCATION AND DESIGNATION
	LAND USE CONTROL BOUNDARY

0 40 80
APPROXIMATE SCALE IN FEET

DRAWN BY CK	DATE 5/22/08	LAND USE CONTROL BOUNDARY UST SITE 1120 OUTLYING LANDING FIELD BRONSON PENSACOLA, FLORIDA	CONTRACT NO. 0055
CHECKED BY	DATE		OWNER NO.
REVISED BY	DATE		APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 / REV. 0

NAVFAC

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

concentration of carcinogenic PAHs exceeds the residential SCTL in sample OLFB20SB03-1012. This concentration does not exceed the industrial SCTL.

As noted above, PAHs were detected in sample OLFB20SB03-1012 and not in the duplicate samples collected from the same location.

2.1.2 Soil to Groundwater Leaching Evaluation

The comparison of the positive detections in the soil samples with the indirect exposure SCTLs (leachability) indicates that none of the chemicals detected exceed a leachability SCTL. Therefore, the soil is not an ongoing source of groundwater contamination.

2.2 GROUNDWATER

Groundwater contamination was initially noted at Site 1120 during the removal of the USTs in 1994. Monitored NA was recommended as a course of action for the site in 2001, but groundwater samples collected during several round of groundwater monitoring indicated that COC concentrations in the groundwater exceeded FDEP site-specific action levels. Therefore, it was recommended that a treatability study using ORC® be completed at UST Site 1120. Baseline groundwater samples were collected in June 2003 before the injection of the ORC® and seven rounds of quarterly monitoring were performed between September 2003 and October 2005. Based on the results of this quarterly monitoring, an additional injection event was recommended. Baseline groundwater samples were again collected in December 2007. Figure 1-2 shows the location of monitoring wells installed at Site 1120.

Table 2-2 provides a summary of the positive detections noted in the June 2003 baseline groundwater samples and in the seven rounds of quarterly monitoring samples collected between September 2003 and October 2005. The table also provides the GCTLs for the compounds detected. Fuel related VOCs (benzene, ethylbenzene, toluene, and xylenes) were detected in 13 of the monitoring wells sampled. However, the concentrations of these VOCs exceeded the GCTLs in only three of the monitoring well sampled (MW-04, MW-05, and MW-14R). Generally the concentrations of VOCs have decreased in each round in each monitoring well and concentrations of VOCs have not exceeded the GCTLs since the fourth round of quarterly monitoring completed in June 2004.

PAHs were detected in 13 of the monitoring wells sampled and the concentrations of the PAHs exceeded the GCTLs in six of the wells sampled. The highest concentrations were detected in wells MW-14R and MW-04. Generally, the concentrations of PAHs have also decreased in each round in each monitoring well.

Table 2-3 provides a summary of the positive detections noted in the groundwater samples collected in December 2007. GCTLs and Natural Attenuation Default Source Concentrations (NADSC) are also provided in this table. Ethylbenzene and total xylenes were the only fuel-related VOCs detected in this round of groundwater samples and they were detected in just one well (MW-14R). Chloroform was the only other VOC detected in this round of samples. None of the VOCs detected exceeded the GCTLs or NADSCs.

Six PAHs were detected in the groundwater samples collected in December 2007. Only three of these PAHs (1-methylnaphthalene, 2-methylnaphthalene, and naphthalene) were detected at concentrations that exceeded the GCTLs, but none of the concentrations exceeded the NADSCs. The exceedances of the GCTLs were detected in only one monitoring well (MW-14R). TPH were also detected in this monitoring well at a concentration that exceeded the GCTL.

3.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the human health risk assessment (HHRA) for soil and groundwater at Site 1120. The objective of the risk assessment is to determine whether detected concentrations of chemicals in soil and groundwater at the site pose significant threats to potential human receptors under current and/or future land use. The potential risks to receptors are estimated based on the assumption no further actions are taken to control contaminant releases or prevent receptor exposure.

3.1 HUMAN HEALTH RISK ASSESSMENT PROTOCOL

The risk assessment was conducted using FDEP guidance specified in the following documents:

- Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-777, F.A.C., (FDEP, February 2005).
- Contaminated Site Cleanup Criteria, Chapter 62-780 F.A.C., (State of Florida, April 2005).

United States Environmental Protection Agency (USEPA) and Navy guidance documents were also used, if applicable. These included:

- Conducting Human Health Risk Assessments under the Environmental Restoration Program, (Department of the Navy, February 2001).

- Risk Assessment Guidance for Superfund (RAGS): Volume I, Human Health Evaluation Manual (Part A), (USEPA, December 1989).

- Soil Screening Guidance: Technical Background Document, (USEPA, May 1996).

- Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, (USEPA Region 4, May 2000).

- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, (USEPA, December 2002).

- RAGS, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance, Dermal Risk Assessment), (USEPA, July 2004).

An HHRA consists of five components: data evaluation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. The following sections contain discussions of the five components as they apply to Site 1120.

3.1.1 Data Evaluation

Data evaluation, the first component of a baseline HHRA, is a two-step, medium-specific task involving the compilation and evaluation of analytical data. The first step involves the compilation of the analytical database and an evaluation of data usability for purposes of HHRA. Under FDEP guidance, the second step of the data evaluation is the selection of a medium-specific list of potential COCs for the site. For Site 1120, potential COCs were identified by comparisons of concentrations of chemicals detected in soil and groundwater to FDEP SCTLs and GCTLs recommended in FDEP Chapter 62-780 F.A.C. or to Cleanup Target Levels (CTLs) developed for alternate land use scenarios, as provided by Chapter 62-780. The soil data were also compared to Criteria based on Leachability to Groundwater provided in the Technical Report for Chapter 62-777 F.A.C. Chapter 62-780 presents a phased risk-based corrective action process (RBCAP) that is iterative and tailors site rehabilitation tasks to site-specific conditions and risks.

3.1.1.1 Data Usability

The datasets used for the HHRA for Site 1120 consist of the following:

- Six subsurface soil samples (and one field duplicate) from three soil borings collected in June 2000. These samples were collected from depths of 4 to 14 feet bgs. The samples were collected after the tank closure and initial remedial action at the site. Contamination (primarily PAHs) was detected in sample OLFB20SB03-1012.

- Fifteen groundwater samples (and one field duplicate) collected in December 2007. These samples are the most recent groundwater samples collected at the site. Contamination (primarily PAHs) was detected in monitoring well MW-14R.

The samples were collected after the removal action which occurred in 1994 and are expected to represent current site conditions.

Only fixed-based analytical results from the field investigations were used in the quantitative risk evaluation. All detected concentrations with "J" qualifiers are considered positive detections and were used in the risk evaluation. Data with "U" and "UJ" qualifiers and data qualified because of blank contamination were retained and evaluated as nondetects. Field measurements and data regarded as

unreliable (i.e., qualified as "R" during the data validation process) were not used in the quantitative risk assessment.

Because the site is an UST site and releases were to the subsurface, surface soil, surface water, and sediment are not considered as media of concern for Site 1120.

3.1.1.2 Identification of Potential Chemicals of Concern

As stated previously, potential COCs were identified by comparisons of concentrations of chemicals in soil and groundwater to FDEP SCTLs and GCTLs provided in the Technical Report for Chapter 62-777 F.A.C. or to CTLs developed for alternate land use scenarios. Details and results of the comparisons are provided in Sections 3.4 and 3.5. Because the samples were analyzed only for organic chemicals, background was not taken into account when identifying potential COCs. The following FDEP criteria were used to identify potential COCs for Site 1120:

Soil Criteria

- Residential SCTLs for Direct Exposure (FDEP, February 2005). The residential SCTLs are based on ingestion, dermal contact, and inhalation of vapors and/or particulates and assume that potential receptors are exposed 350 days per year for 30 years.

- Industrial SCTLs for Direct Exposure (FDEP, February 2005). The industrial SCTLs are based on ingestion, dermal contact, and inhalation of vapors and/or particulates and assume that future fulltime workers are exposed 250 days per year for 25 years.

- Alternate SCTLs for a Future Construction Worker scenario. The construction worker SCTLs were calculated using FDEP and USEPA guidance. These SCTLs are based on ingestion, dermal contact, and inhalation of vapors and/or particulates and assume that future construction workers are exposed 250 days per year for 1 year.

- SCTLs for Leachability based on Groundwater Criteria (FDEP, February 2005). These criteria evaluate the potential for chemicals in soil to impact groundwater and assume that groundwater at the site is used as a source of drinking water.

- Soil Saturation Concentrations (C_{sat}) (FDEP, February 2005). These values are provided in Table 8 of Chapter 62-777 F.A.C. and are used to determine the potential for the presence of free product in soil.

Groundwater Criteria

Screening levels based on the following were used to select potential COCs for groundwater:

- GCTLs for Direct Exposure (FDEP, February 2005). The GCTLs assume a residential drinking water scenario and consist of primary standards [such as Federal Maximum Contaminant Levels (MCLs)], secondary standards (which are not based on adverse health effects), or risk-based values based on ingestion only. The risk-based criteria assume that potential receptors ingest 2 liters of contaminated groundwater 350 days per year for 30 years.

- Natural Attenuation Default Criteria (described in Chapter 62-785.690 F.A.C). NADSCs are developed by multiplying the Groundwater Criteria by 10 for noncarcinogens and by 100 for carcinogens. For those contaminants that present both carcinogenic and noncarcinogenic risks, the Groundwater Criteria are multiplied by 10 as a noncarcinogen. For those contaminants that have both primary and secondary groundwater standards, the Groundwater Criteria and NADSCs are based on the lower of the two standards. The NADSCs are presented in Table V of Chapter 62-777 F.A.C. (FDEP, February 2005).

- Alternate GCTLs for a Future Construction Worker scenario. The construction worker GCTLs were calculated using FDEP and USEPA guidance. These GCTLs are based on incidental ingestion and dermal contact with groundwater and assume that future construction workers are exposed 250 days per year for 1 year.

The SCTLs and GCTLs are based on a target cancer risk level of $1X10^{-6}$ (i.e., a one-in-one million probability of developing cancer) for chemicals classified as carcinogens or on a Hazard Quotient (HQ) of 1.0 (i.e., a no adverse non-carcinogenic effect level) for noncarcinogens.

Exposure to contaminants in subsurface soil is typically evaluated only for potential exposure during construction or excavation activities. Therefore, a construction/excavation worker is considered to be the receptor most likely exposed to subsurface soil. However, subsurface soil could potentially be brought to the surface during future excavation projects resulting in exposure of other receptors such as future residents or workers. For this reason, potential exposure of residents and typical industrial workers to subsurface soils are also evaluated in the risk assessment.

3.2 EXPOSURE ASSESSMENT

The exposure assessment defines and evaluates, quantitatively or qualitatively, the type and magnitude of human exposure to the chemicals present at or migrating from the site. The exposure assessment is

designed to depict the physical setting of the site, to identify potentially exposed populations and applicable exposure pathways, to determine concentrations of potential COCs to which receptors might be exposed, and to estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures at a site are determined based on the most likely pathways of contaminant release and transport, as well as human activity patterns.

3.2.1 Potential Exposure Pathways

A complete exposure pathway has three components: (1) a source of chemicals that can be released to the environment, (2) a route of contaminant transport through an environmental medium, and (3) an exposure or contact point for a human receptor. For Site 1120, these three components are as follows:

3.2.1.1 Sources of Environmental Contamination

The contaminants at Site 1120 are petroleum hydrocarbons, mainly PAHs. The source of contamination at Site 1120 was the three USTs which contained fuel oils and have been removed. Therefore, the primary source of contamination at the site no longer exists. A secondary source of contamination at the site may be subsurface soil which was found to contain TPH and PAHs. TPH and PAHs were also detected in groundwater at the site. However, it should be noted that the PAHs detected in groundwater are not the same as those detected in subsurface soil (See Tables 3-1 and 3-5). Consequently, the analytical data at the site indicate that the current contamination in subsurface soil is not impacting local groundwater.

3.2.1.2 Potential Contaminant Migration Routes

Given that subsurface soil and groundwater contamination has occurred as a result of chemical releases from the USTs and that chemicals may migrate to deeper subsurface soils and groundwater, plausible contaminant release and migration mechanisms at Site 1120 are as follows:

Migration of soil contaminants downward through the soil column with infiltrating precipitation. Chemicals may continue to migrate in groundwater via dispersion and advection in the downgradient direction. Depth to groundwater at the Site is approximately 15 to 20 feet bgs. However, the COCs at the site (PAHs) are not environmentally mobile and do not tend to readily leach through the soil column. PAHs are much more likely to bind to soil and be transported via mass transport mechanisms rather than move in the dissolved phase. The presence of these chemicals in groundwater at the site may be more likely due to releases from the USTs rather than migration from subsurface soil.

Migration of fugitive dusts from subsurface soils into ambient air if construction/excavation activities were to occur in the future. As indicated in Table 3-1, PAHs were detected in only one sample at a depth of

TABLE 3-1

FLORIDA LEVEL 1 (RESIDENTIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA

CAS No.	Parameter	Frequency of Detection	Maximum Concentration (1)	Range of Nondetects	Sample of Maximum Detection	Background Value	Non-Apportioned Florida Residential SCTL- Direct Contact (2)		Ratio of Maximum Concentration/ Non-apportioned Residential SCTL	Is Chemical a Potential Level 1 COC ? (3)	Rationale for Contaminant Deletion or Selection
Volatile Organics (mg/kg)											
108-88-3	TOLUENE	4/6	0.0015 J	0.0052 - 0.0058	OLFB20SB02-0406	NA(4)	7500	N	2.0E-07	No	maximum < SCTL
Semivolatile Organics (mg/kg)											
191-24-2	BENZO(G,H,I)PERYLENE	1/6	0.091	0.068 - 0.07	OLFB20SB03-1012	NA	2500	N	3.6E-05	No	maximum < SCTL
206-44-0	FLUORANTHENE	1/6	0.288 J	0.34 - 0.35	OLFB20SB03-1012	NA	3200	N	9.0E-05	No	maximum < SCTL
85-01-8	PHENANTHRENE	1/6	0.12 J	0.34 - 0.35	OLFB20SB03-1012	NA	2200	N	5.5E-05	No	maximum < SCTL
129-00-0	PYRENE	1/6	0.186 J	0.34 - 0.35	OLFB20SB03-1012	NA	2400	N	7.8E-05	No	maximum < SCTL
	CARCINOGENIC PAHS	1/6	0.2	---	OLFB20SB03-1012	NA	0.1	C	2.0E+00	**Yes**	maximum > SCTL
Petroleum Hydrocarbons (mg/kg)											
TTNUS001	TOTAL PETROLEUM HYDROCARBONS	5/6	70.3	8.8 - 8.8	OLFB20SB01-0406	NA	460	N	1.5E-01	No	maximum < SCTL

Shaded cells indicate that the specified criterion or background level has been exceeded or that the chemical has been selected as a potential COC.
mg/kg = miligram per kilogram
PAHS = polynuclear aromatic hydrocarbons
COC = contaminant of concern

Footnotes:
1 Sample and duplicate are counted as two separate samples when determining the maximum detected concentration.
2 Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL.
4 NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

10-12 feet bgs and toluene was detected at very low concentrations in four samples at depths of 4 to 14 feet bgs. Therefore, exposure to these contaminants could only occur if the soils were uncovered at some future time. Because the FDEP SCTLs are based on ingestion, inhalation, and dermal contact, potential risks from inhalation of dusts/vapors from subsurface soil are evaluated in the soil comparisons.

3.2.1.3 Potential Current and Future Receptors of Concern and Exposure Pathways

OLF Bronson is an active facility and will remain active for the foreseeable future. The area around Site 1120 is used for recreational purposes and access to the area is not restricted. However, because contamination at the site is limited to subsurface soil and groundwater, risks to recreational users are not evaluated in this HHRA, as a complete recreational exposure pathway does not exist. The most likely and reasonable exposure scenario for the site is a future construction/excavation scenario, and risks for construction workers were evaluated. For purposes of completeness and to be conservative, the risk assessment also considered receptor exposure for potential future residential and industrial land use scenarios. Based on current and potential future land use, the following potential receptors were assumed to be exposed to contaminated environmental media at Site 1120:

- **Current Land Use** – No receptors are expected to be exposed under current land use because contamination at Site 1120 is located in subsurface soil and groundwater at the site is not used as a source of drinking water.

- **Construction/Excavation Worker** – A plausible on-site receptor under future land use if construction activities were to occur at the site. This receptor could be exposed to subsurface soil by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors). The construction worker is assumed to be exposed to soil for 250 days per year (USEPA, December 2002). This receptor could also be exposed to chemicals in shallow groundwater via ingestion and dermal contact if the groundwater were contacted during an excavation project.

- **Fulltime Occupational Worker** – An on-site receptor under future land use. This scenario was evaluated assuming that the site was developed for commercial/industrial uses, that subsurface soil was exposed, and that a worker spends the entire workday exposed to chemical contaminants in the excavated soil. The information obtained from this evaluation can be used to provide information for risk management decisions. This receptor could be exposed to the subsurface soil by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors). The occupational worker is expected to be exposed to soil 250 days per year for 25 years (USEPA, May 1993 and December 2002) but less intensely than the construction worker.

- **Hypothetical Future On-Site Child and Adult Resident** – The future residential scenario was quantitatively evaluated in the risk assessment for decision-making purposes although this scenario is unlikely for OLF Bronson. Future residents are assumed to have direct contact with site subsurface soil and exposure occurs by ingestion, dermal contract, and inhalation (i.e., airborne particulates/vapors). Future residents could also be exposed to groundwater only if drinking water wells were installed on the site in the future. The future residential drinking water scenario was evaluated for purposes of completeness. The GCTLs used in this evaluation assume that a receptor is exposed to groundwater by ingestion only. Residential receptors are assumed to be exposed to groundwater 350 days per year for a total of 30 years.

- **Recreational Users/Trespassers** – Not evaluated. Direct contact with subsurface soil is not anticipated for this receptor.

3.2.2 Calculation of Exposure Point Concentrations

The exposure point concentration (EPC), calculated for potential COCs only, is a reasonable estimate of the chemical concentration likely to be contacted over time by a receptor and is used to calculate estimated exposure intakes. The determination of EPCs follows guidance described in Chapter 62-780 F.A.C (FDEP, April 2005) and the Florida upper confidence limit (UCL) Calculator tool.

The following decision rules were used to determine EPCs for Site 1120:

- If a soil dataset contains fewer than 10 samples, the EPC is defined as the maximum detected concentration. Because the dataset for subsurface soil at the site consisted of less than 10 samples, the maximum detected concentration in soil was used as the EPC. Note that soil contamination (mainly PAHs) was found in sample OLFB20SB03-1012 but no PAHs were detected in the field duplicate of this sample (OLFB20SB03-1012-D).

- FDEP guidance (Chapter 62-780 and 62-777) states that the goal for groundwater is to meet GCTLs at all locations. This is because “an individual will be exposed generally to the water where a potable well is placed” (Appendix E of the Technical Report for Chapter 62-777, FDEP, February 2005). Consequently, the groundwater comparisons presented in Section 3.5 compare the concentrations in each individual monitoring well to the GCTLs (Tables 3-5 and 3-6).

3.2.3 Chemical Intake and Risk Estimation

To evaluate risks for future construction workers, risk-based SCTLs and GCTLs were developed for the construction worker using FDEP and USEPA methodology. The exposure assumptions and intake

equations used to calculate the CTLs are presented in the following sections. The toxicity criteria [carcinogenic slope factors (CSFs) and noncarcinogenic reference doses RfDs)] used in the CTLs calculations are discussed in Section 3.3. The risk-based concentrations are established by setting the cancer and non-cancer risk levels at $1x10^{-6}$ or hazard index of 1, respectively, and solving for the associated contaminant concentration as demonstrated in the USEPA Risk Assessment Guidance for Superfund, Part B (USEPA, December 1991). The exposure assumptions selected for the construction worker were based on current USEPA risk assessment guidance (December 1989 and July 2004) and State of Florida guidance (FDEP, April 2005), and are presented in Appendix A. Calculations of the CTLs are also presented in Appendix A.

3.3 TOXICITY ASSESSMENT PROTOCOL

The objective of a toxicity assessment is to identify the potential for human health hazards and adverse effects in exposed populations. A significant portion of the toxicity assessment of the HHRA has been completed because CSFs and RfDs were used by FDEP in the development of the residential and industrial soil SCTLs and GCTLs. A CSF is an indicator of the potency of a chemical carcinogen (i.e., the greater the CSF, the more potent the carcinogen). An RfD is the dose at or below which adverse non-carcinogenic effects are not anticipated. These factors represent quantitative estimates of the relationship between the magnitude and types of exposures and the severity or probability of human health effects and were used to develop risk-based concentrations as described above. The most recent CSFs and RfDs published in Integrated Risk Information System (IRIS) were used in the development of the construction worker SCTLs and GTLs. For some chemicals, such as benzo(g,h,i)perylene, phenanthrene, and TPH, RfDs are not currently available in IRIS. In these cases, the RfDs were obtained from the Technical Report for Chapter 62-777 F.A.C.

3.3.1 Sources of Toxicity Criteria

Oral and inhalation RfDs and CSFs used in this HHRA were obtained from the following primary recommended USEPA sources:

- Integrated Risk Information System (IRIS) (online), May 2008.
- USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment (NCEA) Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by USEPA's Superfund program. PPRTVs are provided in the Region 3 RBC Tables (USEPA Region 3, October 2007) and the Region 9 PRG Tables (USEPA Region 9, October 2004).
- Tables 5a and 5b of the FDEP 62-777 Technical Report (FDEP, February 2005).
- Health Effects Assessment Summary Tables (HEAST) (USEPA, July 1997).

Although RfDs and CSFs can be found in several toxicological sources, USEPA's IRIS online database, which is continuously updated, is the preferred source of toxicity values. The USEPA Region 9 Preliminary Remediation Goal (PRG) Tables (USEPA Region 9, October 2004) and Region 3 Risk-Based Concentration (RBC) tables (USEPA Region 3, October 2007) are also used as sources of toxicity criteria when criteria are not available from the aforementioned references.

3.3.2 Toxicity Criteria for Dermal Exposure

RfDs and CSFs found in literature are frequently expressed as administered doses; therefore, these values are considered to be inappropriate for estimating the risks associated with dermal routes of exposure. Oral dose-response parameters based on administered doses must be adjusted to absorbed doses before comparisons to estimated dermal exposure intakes are made.

The adjustment from administered to absorbed dose was made using the following chemical-specific absorption efficiencies published in RAGS Part E:

$$RfD_{dermal} = (RfD_{oral})(ABS_{GI})$$

$$CSF_{dermal} = (CSF_{oral})/(ABS_{GI})$$

where: ABS_{GI} = absorption efficiency in the gastrointestinal tract

3.3.3 Toxicity Criteria for Carcinogenic Effects of PAHs

Limited toxicity values are available to evaluate the carcinogenic effects from exposure to PAHs. The most extensively studied PAH is benzo(a)pyrene, which is classified by the USEPA as a probable human carcinogen. Although CSFs are available for benzo(a)pyrene, insufficient data are available to calculate CSFs for other carcinogenic PAHs. Toxic effects for these chemicals were evaluated using the concept of estimated orders of potential potency, as presented in USEPA Region 4 guidance (USEPA Region 4, May 2000) and in the Rule 62-777 Technical Report. Toxicity Equivalence Factors (TEFs), which indicate the potency of each PAH compound relative to that of benzo(a)pyrene, are available for select carcinogenic PAHs. The equivalent oral and inhalation CSFs for PAHs other than benzo(a)pyrene are derived by multiplying the CSF for benzo(a)pyrene by the TEF for the PAH compounds. The TEFs for the carcinogenic PAHs are listed in the following table.

Toxic Equivalency Factors for Carcinogenic PAHs

Contaminant	TEF
Benzo(a)pyrene	1.0
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenz(a,h)anthracene	1.0
Indeno(1,2,3-cd)pyrene	0.1

These TEFs were used to convert the individual carcinogenic PAH concentrations to an equivalent concentration of benzo(a)pyrene. The carcinogenic PAHs detected at least once in a soil dataset were used in the calculation. Non-detect results were assigned a value of ½ the sample quantitation limit prior to the calculation.

3.4 RISK EVALUATION

This section describes the methodology used to evaluate risks for exposure to chemicals detected in soil and groundwater at Site 1120. The risk assessment methodology is based on guidance provided in Rule 62-780 F.A.C. which makes use of a phased RBCAP that is iterative and tailors site rehabilitation to site-specific conditions and risks. Rule 62-780 is used in conjunction with Rule 62-777 F.A.C. which provides the methodology used to establish the FDEP CTLs for the residential, commercial/industrial, or alternate land use scenarios. The methodologies described in the following paragraphs are presented in Appendix D and Appendix E of the Technical Report for Chapter 62-777 F.A.C. (FDEP, February 2005)

The FDEP risk characterization is performed, in part, through a series of tables in which concentrations of chemicals detected at a site are compared to various FDEP soil and groundwater criteria or to criteria developed according to guidelines presented in Chapter 62-777 F.A.C. The soil criteria include SCTLs for direct contact (i.e., ingestion, dermal contact, and inhalation), SCTLs for leachability to groundwater, and C_{sat} for an evaluation of free product. The groundwater criteria include GCTLs for direct contact with groundwater (based on ingestion), GCTLs for construction workers assumed to be exposure to groundwater during a future excavation project (based on ingestion and dermal contact), and water solubility values for evaluating the potential for the presence of free product (for organic chemicals).

3.4.1 Florida Methodology for Evaluating Soil

Using the guidance provided in Rules 62-780 and 62-777, soil at Site 1120 was evaluated for the following land use scenarios:

- Residential land use [Risk Management Option (RMO)Level I]
- Commercial/industrial land use (RMO Level II)
- Future Construction (RMO Level III)

The evaluation of the hypothetical future residential and commercial/industrial land use of a site is described under RMO Levels I and II, respectively, of Rule 62.780.680. RMO Level III of the rule allows for the development and use of alternative SCTLs based on, for example, a site-specific risk assessment. In this risk assessment, alternative SCTLs were calculated for future construction workers using the equations and chemical-specific exposure and toxicological data provided in Chapter 62-777 F.A.C., the most recent toxicological information presented in IRIS, and the exposure factors presented in Appendix A.

Future construction workers were evaluated because they are considered to be the only receptors who could reasonably be exposed to contaminated soil at Site 1120. Because the USTs were the source of contamination, the soil data consists of subsurface soil samples collected from depths of 4 to 14 feet bgs and only the concentration of benzo(a)pyrene [0.108 milligram per kilogram (mg/kg)] in one sample (OLFB20SB03-1012) slightly exceeded the residential SCTL (0.1 mg/kg). It should be noted no PAHs were detected in the field duplicate of this sample (OLFB20SB03-1012-D). At this depth (10 – 12 ft bgs) only a future construction worker could be exposed to the benzo(a)pyrene contamination. As indicated previously, the construction worker is assumed to be exposed 250 days per year for one year. This is considered to conservative and unrealistic because the impacted area is expected to be small and a worker is unlikely to spend 250 days in such a small area. Supporting documentation for the development of the construction worker SCTLs is presented in Appendix A.

As per FDEP guidance, subsurface soils at Site 1120 were first evaluated for residential land use (Level I) by a comparison of chemical concentrations in soils to the relevant residential SCTLs. The process was then repeated for commercial/industrial land use (Level II) and a potential construction/excavation scenario (Level III). The comparisons conducted for each level are presented in Tables 3-1 through 3-3 with the chemicals exceeding the relevant screening levels (i.e., the potential COCs) highlighted. Supporting documentation is presented in Appendix A, as necessary. Using the guidance provided in Chapters 62-777 and 62-780 the following evaluations were performed for Site 1120:

3.4.1.1 Comparison with Direct Contact SCTLs

According to the FDEP guidance documents, under Risk Management Options Level I and Level II, the maximum detected concentration of each contaminant detected in soil may be compared with the respective default SCTL listed in Chapter 62-777, F.A.C. or, the 95% UCL of the mean of the site concentrations can be compared with apportioned chronic toxicity-based SCTLs. Under Risk

TABLE 3-2

FLORIDA LEVEL 3 (CONSTRUCTION WORKER) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA

CAS No.	Parameter	Frequency of Detection	Maximum Concentration (1, 2)	Range of Nondetects	Sample of Maximum Detection	Background Value	Non-Apportioned Florida Construction Worker SCTL- Direct Contact (3)		Target Organ (4)	Ratio of Maximum Concentration/ Non-apportioned Construction SCTL	Simple Apportioned Florida Residential SCTL- Direct Contact (5)	Is Chemical a Potential Level 3 COC ? (6)	Rationale for Contaminant Deletion or Selection(7)
	Volatile Organics (mg/kg)												
108-88-3	TOLUENE	4/6	0.0015 J	0.0052 - 0.0058	OLFB20SB02-0406	NA(8)	14000	N	Kidney, Liver, Neurological	1.1E-07	14000	No	maximum < SCTL
	Semivolatile Organics (mg/kg)												
191-24-2	BENZO(G,H,I)PERYLENE	1/6	0.091	0.068 - 0.07	OLFB20SB03-1012	NA	6400	N	Neurological	1.4E-05	6400	No	maximum < SCTL
206-44-0	FLUORANTHENE	1/6	0.288 J	0.34 - 0.35	OLFB20SB03-1012	NA	8400	N	Blood, Kidney, Liver	3.4E-05	8400	No	maximum < SCTL
85-01-8	PHENANTHRENE	1/6	0.12 J	0.34 - 0.35	OLFB20SB03-1012	NA	6100	N	Kidney	2.0E-05	6100	No	maximum < SCTL
129-00-0	PYRENE	1/6	0.186 J	0.34 - 0.35	OLFB20SB03-1012	NA	6300	N	Kidney	3.0E-05	6300	No	maximum < SCTL
	CARCINOGENIC PAHS	1/6	0.2	0.068 - 0.07	OLFB20SB03-1012	NA	2.1	C	Carcinogen	9.5E-02	2.1	No	maximum < SCTL
	Petroleum Hydrocarbons (mg/kg)												
TTNUS001	TOTAL PETROLEUM HYDROCARBONS	5/6	70.3	8.8 - 8.8	OLFB20SB01-0406	NA	2000	N	Multiple Endpoints	3.5E-02	2000	No	maximum < SCTL

Shaded cells indicate that the specified criterion or background level has been exceeded or that the chemical has been selected as a potential COC.
mg/kg = miligram per kilogram
PAHS = polynuclear aromatic hydrocarbons
COC = contaminant of concern

Footnotes:
1 Sample and duplicate are counted as two separate samples when determining the maximum detected concentration.
2 Because the dataset consists of less than 10 samples, the maximum concentration is used as the exposure point concentration (EPC).
3 SCTLs for construction workers were developed using the methods presented in Chapter 62-777, F.A.C., April 2005 and current USEPA guidance (See Section 3.2.3 of text)..
4 Target organs are obtained from Table II, Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., April 2005.
5 The value of the simple apportioned SCTL is determined by dividing the non-apportioned SCTL by the number carcinogenic chemicals or by the number of chemicals impacting the same target organ for noncarcinogens. If the ratio of the maximum concentration to the non-apportioned SCTL is less than 0.1, that chemical is not included in the apportionment process (Chapter 62-777 F.A.C.).
6 According to the Chapter 62-780 F.A.C., a chemical is identified as a COC if the maximum concentration is greater than 3 times the non-apportioned SCTL.
7 A chemical is selected as a COC if the EPC/apportioned SCTL ratio is greater than 1 or if the maximum concentration/non-apportioned SCTL ratio is greater than 3.
8 NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 3-3

COMPARISON WITH SCTLS FOR LEACHABILITY TO GROUNDWATER AND CSAT LIMITS - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA

CAS No.	Parameter	Frequency of Detection	Maximum Concentration(1)	Sample of Maximum Detection	Background Value(1)	Florida Leachability to GW (2)	Soil Saturation Limit, C_{sat} (3)
	Volatile Organics (mg/kg)						
108-88-3	TOLUENE	4/6	0.0015 J	OLFB20SB02-0406	NA(4)	0.5	650
	Semivolatile Organics (mg/kg)						
191-24-2	BENZO(G,H,I)PERYLENE	1/6	0.091	OLFB20SB03-1012	NA	32000	---
206-44-0	FLUORANTHENE	1/6	0.288 J	OLFB20SB03-1012	NA	1200	---
85-01-8	PHENANTHRENE	1/6	0.12 J	OLFB20SB03-1012	NA	250	---
129-00-0	PYRENE	1/6	0.186 J	OLFB20SB03-1012	NA	880	---
56-55-3	BENZO(A)ANTHRACENE	1/6	0.123	OLFB20SB03-1012	NA	0.8	---
50-32-8	BENZO(A)PYRENE	1/6	0.108	OLFB20SB03-1012	NA	8	---
205-99-2	BENZO(B)FLUORANTHENE	1/6	0.136	OLFB20SB03-1012	NA	2.4	---
207-08-9	BENZO(K)FLUORANTHENE	1/6	0.0782	OLFB20SB03-1012	NA	24	---
218-01-9	CHRYSENE	1/6	0.136 J	OLFB20SB03-1012	NA	77	---
193-39-5	INDENO(1,2,3-CD)PYRENE	1/6	0.142	OLFB20SB03-1012	NA	6.6	---
	Petroleum Hydrocarbons (mg/kg)						
TTNUS001	TOTAL PETROLEUM HYDROCARBONS	5/6	70.3	OLFB20SB01-0406	NA	340	---

Shaded cells indicate that the specified criterion or background level has been exceeded.
mg/kg = miligram per kilogram
PAHS = polynuclear aromatic hydrocarbons
COC = contaminant of concern
GW = Groundwater

Footnotes:

1 Sample and duplicate are counted as two separate samples when determining the maximum detected concentration.
2 Soil Cleanup Target Levels (SCTLs) for Leachability Based on Groundwater Criteria, Table 2, Chapter 62-777 Technical Report (FDEP, February 2005).
3 Soil Saturation Limits (C_{sat}), Table 8, Chapter 62-777 Technical Report (FDEP, February 2005).
4 NA - Not Applicable. According to proposed Florida Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

Management Option Level III, UCLs must be compared with apportioned chronic toxicity-based SCTLs only. However, because the subsurface soil dataset consisted of less than ten samples and most chemicals were positively detected in only one sample, the maximum detected concentration was used in the Level I, II and III evaluations.

Therefore, if the maximum detected concentration for a chemical exceeds the direct contact SCTL for RMO Levels I and II, the constituent is identified as a potential COC and may be further evaluated using various apportionment approaches described in the following sections.

Because FDEP guidance stipulates that SCTLs must be apportioned when using Risk Management Options Level III, the following approach was used when evaluating risks for the construction worker, as described in Appendix D of the Technical Report.

Simple Apportionment. For simple apportionment the default SCTL for each chemical is divided by the number of chemicals that produce the same type of toxicity. For carcinogens, the value of the simple apportioned SCTL is calculated by dividing the non-apportioned SCTL by the number carcinogenic chemicals detected in a surface or subsurface soil dataset. For example, if five carcinogens were detected in a surface soil dataset for a site, the simple apportioned SCTLs for carcinogens are the non-apportioned SCTLs divided by 5 (FDEP, February 2005). For Site 1120, only one constituent (carcinogenic PAHs) is classified a carcinogenic. Therefore, the construction worker SCTL for carcinogenic PAHs was not apportioned (Table 3-3). For noncarcinogens, the simple apportioned SCTL is determined by dividing the non-apportioned SCTL by the number of chemicals impacting the same target organ. If the liver, for example, is identified as the target organ for 3 noncarcinogens in a dataset, the simple apportioned SCTLs for those chemicals are the non-apportioned values divided by 3.

Not all SCTLs should be apportioned. The Technical Report (FDEP, February 2005) lists the following exceptions to apportioning:

1. Do not apportion an SCTL based on natural background concentration or a practical quantitation limit. These are criteria that are not directly risk-based, and therefore are not subject to apportionment. This does not apply to Site 1120 because only organic chemicals were evaluated.

2. Do not apportion an SCTL based on acute toxicity. These SCTLs are always regarded as not-to-exceed values, and the default value should be compared with the maximum concentration on site. [Note that acute toxicity SCTLs are applicable only in situations where small children might be present, such as a residence, playground, or school.] This does not apply to Site 1120 because none of the chemicals detected in soil at the site had SCTLs based on acute toxicity values.

3. Do not apportion lead SCTLs. Both residential and commercial/industrial lead SCTLs are based on a unique type of toxicological analysis that is not amenable to the standard apportionment process. This does not apply to Site 1120 because lead was not evaluated.

4. Do not apportion the SCTLs for chemicals present in low concentrations. Eliminate from consideration at a site chemicals whose maximum concentration is less than or equal to 1/10 the default SCTL. Chemicals present in low concentrations are unlikely to contribute substantially to risk and unnecessarily complicate the apportionment process. As shown in Table 3-3, the maximum concentrations of all detected chemicals were less than 1/10 of the default SCTLs for subsurface soil. Therefore, it was not necessary to apportion any of the SCTLs for the construction worker.

5. Do not apportion the SCTLs for chemicals detected infrequently. A chemical can be eliminated from consideration at a site if it is detected a) in only one out of 10 or more samples, or 5% or fewer out of 20 or more samples, and in only one environmental medium; and b) in low concentrations (no more than the default SCTL); and c) there is no reason to believe that the chemical may be present due to historical site activities. These criteria are intended to eliminate chemical detections that are artifacts from sampling, analytical, or other problems. They are not intended to eliminate chemicals present due to site activities in localized areas of contamination. This does not apply to subsurface soil for Site 1120 because the dataset consisted of only six samples.

3.4.1.2 Comparison with Leachability-based SCTLs

The potential for leaching was addressed through comparisons with SCTLs for Leachability Based on Groundwater Criteria (FDEP, February 2005). Unlike direct contact SCTLs, which are based primarily on long-term exposure covering a specified area, leachability-based default SCTLs are intended to protect water resources at all locations. Consequently, maximum rather than average (or 95% UCL) concentrations are compared with leaching criteria. If the maximum concentration of a chemical exceeds its respective leachability SCTL, that chemical is identified as a potential COC. The leachability comparisons are presented in Table 3-4.

3.4.1.3 Evaluation of Free Product in Soil

The potential for the presence of free product (for organic chemicals) was evaluated by comparing maximum site concentrations to C_{sat} limits (Table 3-4). The C_{sat} values are provided in Table 8 of Chapter 62-777 F.A.C.(FDEP, February 2005). The C_{sat} comparisons in Table 3-4 indicated that the concentrations of all organic chemicals detected in subsurface soil at Site 1120 were less than the C_{sat} levels. Therefore, it is unlikely these chemicals are present as free product at the site. Note that FDEP

TABLE 3-4

COMPARISON OF CONCENTRATIONS IN GROUNDWATER TO GROUNDWATER CTLS AND NATURAL ATTENUATION CRITERIA
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 1 OF 3

WELL NAME	GCTL[1]	NADSC[2]	MW-5R	MW-7	MW-14R	MW-14R DUP	MW-16R	MW-24	MW-25
SAMPLE ID			BRN-1120-MW05R	BRN-1120-MW07	BRN-1120-MW14R	BRN-1120-DUP01-120	BRN-1120-MW16R	BRN-1120-MW24	BRN-1120-MW25
SAMPLING EVENT			Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
COLLECTION DATE			12/13/07	12/13/07	12/14/07	12/14/07	12/13/07	12/13/07	12/13/07
Volatile Organics (µg/L)									
CHLOROFORM	70	700	0.21U	0.58 J	0.21U	0.21U	0.39 J	1.6	0.26 J
ETHYLBENZENE	30	300	0.2 U	0.2 U	6	6.2	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	20	200	0.56 U	0.56 U	9.3	10.2	0.56 U	0.56 U	0.56 U
Semivolatile Organics (µg/L)									
1-METHYLNAPHTHALENE (3)	28	280	0.25 U	0.24 U	**140**	**133**	0.34 J	0.25 J	0.25 U
2-METHYLNAPHTHALENE	28	280	0.25 U	0.24 U	**178**	**172**	0.43 J	0.65 J	0.25 U
ACENAPHTHENE	20	200	0.5 U	0.49 U	2 U	2 U	0.5 U	0.49 U	0.5 U
FLUORENE	280	2800	0.25 U	0.24 U	4.8	4.7	0.25 U	0.24 U	0.25 U
NAPHTHALENE	14	140	0.25 U	0.24 U	**77.5**	**73.9**	0.25 U	0.24 U	0.25 U
PHENANTHRENE	210	2100	0.5 U	0.49 U	2.6 J	2.5 J	0.5 U	0.49 U	0.5 U
Petroleum Hydrocarbons (µg/L)									
TOTAL PETROLEUM HYDROCARBONS	5,000	50,000	1,113	170 U	**6960**	**6100**	170 U	206 J	170 U

TABLE 3-4

COMPARISON OF CONCENTRATIONS IN GROUNDWATER TO GROUNDWATER CTLS AND NATURAL ATTENUATION CRITERIA
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 2 OF 3

WELL NAME	GCTL[1]	NADSC[2]	MW-27	MW-28	MW-29	MW-30	MW-36	MW-37	MW-38
SAMPLE ID			BRN-1120-MW27	BRN-1120-MW28	BRN-1120-MW29	OLFB1120MW30	BRN-1120-MW32	BRN-1120-MW35	BRN-1120-MW35
SAMPLING EVENT			Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
COLLECTION DATE			12/13/07	12/14/07	12/14/07	12/14/07	12/13/07	12/13/07	12/13/07
Volatile Organics (µg/L)									
CHLOROFORM	70	700	3.3	4.1	11.1	5.6	3.5	25.5	0.21U
ETHYLBENZENE	30	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	20	200	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
Semivolatile Organics (µg/L)									
1-METHYLNAPHTHALENE (3)	28	280	0.25 U	0.25 U	0.25 U	1.2	0.25 U	0.24 U	0.24 U
2-METHYLNAPHTHALENE	28	280	0.25 U	0.25 U	0.25 U	2.4	0.25 U	0.24 U	0.69 J
ACENAPHTHENE	20	200	0.5 U	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U
FLUORENE	280	2800	0.25 U	0.25 U	0.25 U	0.48 J	0.25 U	0.24 U	0.24 U
NAPHTHALENE	14	140	0.25 U	0.25 U	0.25 U	0.26 J	0.25 U	0.24 U	0.36 J
PHENANTHRENE	210	2100	0.5 U	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U
Petroleum Hydrocarbons (µg/L)									
TOTAL PETROLEUM HYDROCARE	5,000	50,000	180 U	170 U	170 U	702	170 U	160 U	170 U

TABLE 3-4

COMPARISON OF CONCENTRATIONS IN GROUNDWATER TO GROUNDWATER CTLS AND NATURAL ATTENUATION CRITERIA
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 3 OF 3

WELL NAME SAMPLE ID SAMPLING EVENT COLLECTION DATE	GCTL[1]	NADSC[2]	MW-39 BRN-1120-MW35 Baseline 12/13/07	MW-40 BRN-1120-MW35 Baseline 12/13/07
Volatile Organics (µg/L)				
CHLOROFORM	70	700	0.21U	0.47 J
ETHYLBENZENE	30	300	0.2 U	0.2 U
TOTAL XYLENES	20	200	0.56 U	0.56 U
Semivolatile Organics (µg/L)				
1-METHYLNAPHTHALENE (3)	28	280	0.24 U	12.8
2-METHYLNAPHTHALENE	28	280	0.24 U	17.2
ACENAPHTHENE	20	200	0.49 U	0.54 J
FLUORENE	280	2800	0.24 U	1.5
NAPHTHALENE	14	140	0.24 U	0.96 J
PHENANTHRENE	210	2100	0.49 U	1.1
Petroleum Hydrocarbons (µg/L)				
TOTAL PETROLEUM HYDROCARBONS	5,000	50,000	170 U	1,410

Footnotes:

1 Groundwater Cleanup Target Level as provided in Chapter 62-777, FAC, April 2005.
2 Natural Attenuation Default Screening Criteria as provided in Chapter 62-777, F.A.C.
3 A chemical is selected as a potential COC if the maximum concentration is greater than the groundwater CTL of the Natural Attenuation Screening Level..

J = Estimated concentration
U = non-detect value
µg/L = microgram per liter
COC = contaminant of concern

provides a C_{sat} value for only one chemical (toluene) detected in subsurface soil at Site 1120. Therefore, this analysis is not applicable to most of the chemicals detected at Site 1120.

3.4.2 Florida Methodology for Evaluating Groundwater

This section describes the methodology used to evaluate groundwater at Site 1120 using guidelines presented in Rules 62-780 and 62-777, F.A.C. A detailed discussion of the FDEP approach for evaluating groundwater is presented in Appendix E of the Rule 62-777 Technical Report (FDEP, February 2005).

Using the guidance provided in Rules 62-780 and 62-777, groundwater at Site 1120 was evaluated for residential land use (RMO Level I) and for a construction worker scenario (RMO Level III). As with soil, the FDEP risk characterization for groundwater is performed by comparing concentrations of chemicals detected in groundwater with FDEP groundwater criteria (or to criteria developed according to guidelines presented in Chapters 62-777).

In Risk Management Option Level I, the applicable GCTL is usually the default value for that contaminant in the groundwater as presented in Table 1 of the Technical Report. The GCTLs for potential residential exposure are based on primary and secondary standards (e.g., MCLs) or on human health risk-based criteria, assuming that the groundwater is used as a potable water source (and are based on the ingestion route of exposure only as shown in Figures 1 and 2 of the February 2005 Technical Report for Chapter 62-777 F.A.C.). For noncarcinogens, the risk-based CTLs are calculated based on a hazard index of 1 and incorporate a default relative source contribution factor of 0.2. The relative source contribution factor means, in effect, that no more than 20% of the total allowable intake of the contaminant can come from contaminated water. For carcinogens, the default GCTL is based on an excess cancer risk of 1×10^{-6}.

The Level I GCTLs for most of the constituents detected in groundwater at Site 1120 are risk-based values (e.g., naphthalene, 1-methylnapthalene, and 2-methylnaphthalene). The GCTLs for ethylbenzene, xylenes, and acenaphthene are secondary standards and are not based on human health effects. The guidance presented in 62-777 Technical Report states that CTLs based on primary or secondary standards should not be apportioned. As with soils, if alternative CTLs are developed, the default values should be apportioned. However, the alternate CTLs should not be lower than the primary or secondary standard.

Under RMO Level III, GCTLs were developed to account for possible exposure of construction workers to contaminants in shallow groundwater in a future construction/excavation project. The construction worker GCTLs were developed using guidance from USEPA RAGS-Part A and Part B and are based on

ingestion and dermal contact. The GCTLs assume that construction workers are exposed 250 days per year for one year. Details and calculations for the construction worker GCTLs for groundwater are presented in Appendix A.

FDEP guidance states that the goal for groundwater (unlike soil) is to meet GCTLs at all locations. This is because "an individual will be exposed generally to the water where a potable well is placed" (Appendix E of the Technical Report for Chapter 62-777, FDEP, February 2005). Consequently, the Level I and Level III comparisons for groundwater are presented for each individual monitoring well (Tables 3-5 and 3-6).

The following evaluations for Site 1120 were performed according to Rules 62-777 and 62-780:

- ***Comparison of detected concentrations in each well to GCTLs (RMO Level I)***. If the maximum detected concentration for a chemical exceeds the GCTL, the constituent is identified as a potential COC for residential land use at the site.

- ***Comparison of concentrations in each well to simple apportioned GCTLs for future construction workers (RMO Level III)***. If the maximum detected concentration for a chemical exceeds the GCTL, the constituent is identified as a potential COC for the construction worker scenario.

- ***Comparison of detected concentrations in each well to Natural Attenuation Default Source Concentrations.*** The use of the NADSC are stipulated in Chapter 62-785.690 F.A.C. This rule states that "Natural attenuation with monitoring is an allowable strategy for site rehabilitation depending on the current and projected use of groundwater in the vicinity of the site and the individual site characteristics, provided human health, public safety, and the environment are protected". NADSCs are developed by multiplying the Groundwater Criteria by 10 for noncarcinogens and by 100 for carcinogens, except in the case of carcinogenic elements where the Groundwater Criteria are also multiplied by 10 as noncarcinogens. For those contaminants that have both primary and secondary groundwater standards, the Groundwater Criteria and NADSCs are based on the lower of the two standards. The NADSCs are presented in Table V of Chapter 62-777 F.A.C. The NA evaluation is presented in Table 3-5.

- ***Evaluation of Free Product in Groundwater***. The potential for the presence of free product (for organic chemicals) was evaluated by comparing maximum site concentrations to water solubility values presented in Table 4, Chapter 62-777 F.A.C. (FDEP, April 2005). The water solubility comparisons indicated the concentrations of organic chemicals detected in groundwater at Site 1120

TABLE 3-5

FLORIDA LEVEL 2 (INDUSTRIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA

CAS No.	Parameter	Frequency of Detection	Maximum Concentration (1)	Range of Nondetects	Sample of Maximum Detection	Concentration Used for Screening	Background Value	Non-Apportioned Florida Industrial SCTL- Direct Contact (2)		Ratio of Maximum Concentration/ Non-apportioned Industrial SCTL	Is Chemical a Potential Level 2 COC ? (3)	Rationale for Contaminant Deletion or Selection
	Volatile Organics (mg/kg)											
108-88-3	TOLUENE	4/6	0.0015 J	0.0052 - 0.0058	OLFB20SB02-0406	0.0015	NA(4)	60000	N	2.5E-08	No	maximum < SCTL
	Semivolatile Organics (mg/kg)											
191-24-2	BENZO(G,H,I)PERYLENE	1/6	0.091	0.068 - 0.07	OLFB20SB03-1012	0.091	NA	52000	N	1.8E-06	No	maximum < SCTL
206-44-0	FLUORANTHENE	1/6	0.288 J	0.34 - 0.35	OLFB20SB03-1012	0.288	NA	59000	N	4.9E-06	No	maximum < SCTL
85-01-8	PHENANTHRENE	1/6	0.12 J	0.34 - 0.35	OLFB20SB03-1012	0.12	NA	36000	N	3.3E-06	No	maximum < SCTL
129-00-0	PYRENE	1/6	0.186 J	0.34 - 0.35	OLFB20SB03-1012	0.186	NA	45000	N	4.1E-06	No	maximum < SCTL
	CARCINOGENIC PAHS	1/6	0.2	0.068 - 0.07	OLFB20SB03-1012	0.2	NA	0.7	C	2.9E-01	No	maximum < SCTL
	Petroleum Hydrocarbons (mg/kg)											
TTNUS001	TOTAL PETROLEUM HYDROCARBONS	5/6	70.3	8.8 - 8.8	OLFB20SB01-0406	70.3	NA	2700	N	2.6E-02	No	maximum < SCTL

Shaded cells indicate that the specified criterion or background level has been exceeded or that the chemical has been selected as a potential COC.
mg/kg = miligram per kilogram
PAHS = polynuclear aromatic hydrocarbons
COC = contaminant of concern

Footnotes:
1 Sample and duplicate are counted as two separate samples when determining the maximum detected concentration.
2 Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL.
4 NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 3-6

COMPARISON OF CONCENTRATIONS OF CHEMICALS DETECTED IN GROUNDWATER TO CONSTRUCTION WORKER CTLS
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 1 OF 2

WELL NAME SAMPLE ID SAMPLING EVENT COLLECTION DATE	Non-Apportioned Construction Worker GCTL(1)	Target Organ(2)	MW-5R BRN-1120-MW05R Baseline 12/13/07	MW-7 BRN-1120-MW07 Baseline 12/13/07	MW-7 Ratio	MW-14R BRN-1120-MW14R Baseline 12/14/07	MW-14R DUP BRN-1120-DUP01-1207 Baseline 12/14/07	MW-16R BRN-1120-MW16R Baseline 12/13/07	MW-24 BRN-1120-MW24 Baseline 12/13/07	MW-25 BRN-1120-MW25 Baseline 12/13/07
Volatile Organics (µg/L)										
CHLOROFORM	4,100	Liver	0.21U	0.58 J	1.4E-04	0.21U	0.21U	0.39 J	1.6	0.26 J
ETHYLBENZENE	7,900	Developmental, Kidney, Liver	0.2 U	0.2 U		6	6.2	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	320,000	Neurological	0.56 U	0.56 U		9.3	10.2	0.56 U	0.56 U	0.56 U
Semivolatile Organics (µg/L)										
1-METHYLNAPHTHALENE (4)	8,200	Nasal	0.25 U	0.24 U		140	133	0.34 J	0.25 J	0.25 U
2-METHYLNAPHTHALENE	8,200	Nasal	0.25 U	0.24 U		178	172	0.43 J	0.65 J	0.25 U
ACENAPHTHENE	41,000	Liver	0.5 U	0.49 U		2 U	2 U	0.5 U	0.49 U	0.5 U
FLUORENE	120,000	Blood	0.25 U	0.24 U		4.8	4.7	0.25 U	0.24 U	0.25 U
NAPHTHALENE	82,000	Nasal	0.25 U	0.24 U		77.5	73.9	0.25 U	0.24 U	0.25 U
PHENANTHRENE	61,000	Kidney	0.5 U	0.49 U		2.6 J	2.5 J	0.5 U	0.49 U	0.5 U
Petroleum Hydrocarbons (µg/L)										
TOTAL PETROLEUM HYDROCARBONS	11,000	Mixed Endpoints	1,113	170 U		6,960	6,100	170 U	206 J	170 U

TABLE 3-6

COMPARISON OF CONCENTRATIONS OF CHEMICALS DETECTED IN GROUNDWATER TO CONSTRUCTION WORKER CTLS
SITE 1120 - OLF BRONSON
NAS PENSACOLA, FLORIDA
PAGE 2 OF 2

WELL NAME SAMPLE ID SAMPLING EVENT COLLECTION DATE	Non-Apportioned Construction Worker GCTL(1)	MW-27 BRN-1120-MW27 Baseline 12/13/07	MW-28 BRN-1120-MW28 Baseline 12/14/07	MW-29 BRN-1120-MW29 Baseline 12/14/07	MW-30 OLFB1120MW30 Baseline 12/14/07	MW-36 BRN-1120-MW32 Baseline 12/13/07	MW-37 BRN-1120-MW35 Baseline 12/13/07	MW-38 BRN-1120-MW35 Baseline 12/13/07	MW-39 BRN-1120-MW35 Baseline 12/13/07	MW-40 BRN-1120-MW35 Baseline 12/13/07
Volatile Organics (µg/L)										
CHLOROFORM	4,100	3.3	4.1	11.1	5.6	3.5	25.5	0.21U	0.21U	0.47 J
ETHYLBENZENE	7,900	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TOTAL XYLENES	320,000	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
Semivolatile Organics (µg/L)										
1-METHYLNAPHTHALENE (4)	8,200	0.25 U	0.25 U	0.25 U	1.2	0.25 U	0.24 U	0.24 U	0.24 U	12.8
2-METHYLNAPHTHALENE	8,200	0.25 U	0.25 U	0.25 U	2.4	0.25 U	0.24 U	0.69 J	0.24 U	17.2
ACENAPHTHENE	41,000	0.5 U	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U	0.49 U	0.54 J
FLUORENE	120,000	0.25 U	0.25 U	0.25 U	0.48 J	0.25 U	0.24 U	0.24 U	0.24 U	1.5
NAPHTHALENE	82,000	0.25 U	0.25 U	0.25 U	0.26 J	0.25 U	0.24 U	0.36 J	0.24 U	0.96 J
PHENANTHRENE	61,000	0.5 U	0.49 U	0.49 U	0.5 U	0.5 U	0.48 U	0.48 U	0.49 U	1.1
Petroleum Hydrocarbons (µg/L)										
TOTAL PETROLEUM HYDROCARBONS	11,000	180 U	170 U	170 U	702	170 U	160 U	170 U	170 U	1,410

Shaded cells indicate that the specified criterion or background level has been selected as a potential COC.

Footnotes:
1 Groundwater CTLs for construction workers were developed using the methods presented in Chapter 62-777, F.A.C., April 2005 and current USEPA guidance (See Section 3.2.3 of text).
2 Target organs are obtained from Table II, Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., April 2005.
3 The value of the simple apportioned SCTL is determined by dividing the non-apportioned SCTL by the number carcinogenic chemicals or by the number of chemicals impacting the same target organ for noncarcinogens. If the ratio of the maximum concentration to the non-apportioned SCTL is less than 0.1, that chemical is not included in the apportionment process (Chapter 62-777 F.A.C.).
4 A chemical is selected as a potential COC if the EPC/apportioned SCTL ratio is greater than 1 or if the maximum concentration/non-apportioned SCTL ratio is greater than 3.

J = Estimated concentration
U = non-detect value
µg/L = micrograms per liter

in 2007 were significantly less than their respective water solubilities. Therefore, it is unlikely these chemicals are present as free product in groundwater at the site.

3.5 RISK CHARACTERIZATION RESULTS

This section contains a summary of the results of the risk characterization for Site 1120 conducted using guidelines presented in Florida Rule 62-780 F.A.C. and the Rule 62-777 Technical Report. The results are summarized in Tables 3-1 through 3-6 and are discussed below.

3.5.1 Results of Subsurface Soil Evaluation

Level 1 Evaluation (Residential)

Table 3-1 presents a comparison of the maximum detected chemical concentrations in subsurface soil to the FDEP residential SCTLs. The residential SCTLs are based on the assumption that hypothetical future residents (child and adult) are exposed 350 days per year for 30 years by ingestion, inhalation, and dermal contact. The following chemicals were identified as exceeding the Level 1 SCTLs and were retained as potential COCs for residential exposures to subsurface soil at Site 1120:

- Carcinogenic PAHs (expressed as benzo(a)pyrene equivalents). Note that the maximum detected PAH concentration was less than three times the unapportioned residential SCTL, as required by Chapter 62-780 F.A.C. and 62-777 F.A.C guidance.

There is considerable overestimation of risk in the residential subsurface soil evaluation because PAHs were detected in only one sample at a depth of 10 – 12 feet bgs. It is very unlikely that future residents would be exposed to soil at this depth. In addition, the site is currently located in an area used for recreational purposes and is anticipated that the site will not be developed for residential purposes in the foreseeable future.

Level II (Industrial, Future Fulltime Workers)

The results of the Level I evaluation identified one potential COC for Site 1120. Therefore, a Level II evaluation was conducted. A comparison of the maximum chemical concentrations in subsurface soil to the FDEP industrial SCTLs is presented in Table 3-2. The industrial SCTLs are based on the assumption that workers are exposed 250 days per year for 25 years by ingestion, inhalation, and dermal contact. The maximum concentrations of all detected compounds were less than the industrial SCTLs.

Level III (Construction Worker)

As stated previously, a construction worker scenario was evaluated for Site 1120 because a future construction worker was the only potential receptor that could reasonably be expected to be exposed to subsurface soil contamination at the site. Alternative SCTLs for construction worker exposures were derived following the methodology presented in Appendix A. The construction worker SCTLs were based on the assumption that workers are exposed 250 days per year for 1 year by ingestion, inhalation, and dermal contact. A comparison of the maximum detected chemical concentrations for subsurface soil to the apportioned and unapportioned alternative SCTLs is presented in Table 3-3. As shown in the table, the concentrations of all constituents were less than the apportioned and unapportioned alternate SCTLs. In addition, the ratios of the maximum concentrations to the unapportioned SCTLs were less than 0.1. Therefore, no constituents were retained as potential COCs for the construction worker exposure scenario.

Comparison of Chemicals in Subsurface Soil with Leachability SCTLs

Table 3-4 presents comparisons of maximum detected concentrations in subsurface soil with Florida criteria based on leachability to groundwater. As shown in the table, maximum concentrations of all detected chemicals were less than the leachability criteria indicating that there is minimal potential for contaminants detected in subsurface soil to adversely impact groundwater. It should also be noted that none of the chemicals detected in subsurface soil at the site were detected in any groundwater samples at the site indicating that migration of chemicals from subsurface soil to groundwater has not occurred.

Table 3-4 also presents comparisons of maximum concentrations with C_{sat} to evaluate the potential for presence of free product. As shown in the table, the concentration of toluene in subsurface soil was significantly less than the C_{sat} (values were available only for toluene), indicating that free product is not present in subsurface soil.

3.5.2 Results of Groundwater Evaluation

Level I Groundwater Evaluation (Residential)

Groundwater was evaluated for future residential use (Level I). Table 3-5 presents a comparison of the positively detected concentrations in December 2007 groundwater samples to the FDEP GCTLs. The following constituents were identified as exceeding the Level I GCTLs and were retained as potential COCs for residential exposures to groundwater at Site 1120:

- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Naphthalene
- Total Petroleum Hydrocarbons

These exceedances occurred only at location MW-14R. The concentrations of 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene in this sample were also greater than three times the GCTLs.

Comparison of Groundwater Concentrations with Natural Attenuation Default Concentrations

Table 3-5 also presents comparisons of concentrations in groundwater samples with FDEP NADSCs. As shown in the table, chemical concentrations in all samples were less than the NA criteria.

Level III Groundwater Evaluation (Construction Worker)

Table 3-6 presents a comparison of the positively detected concentrations in groundwater samples to GCTLs developed for potential construction worker exposures. The construction worker GCTLs were based on the assumption that workers are exposed 250 days per year for 1 year by ingestion and dermal contact (except PAHs). No chemicals exceeded the Level III GCTLs for exposure of future construction workers to groundwater at Site 1120.

3.6 HUMAN HEALTH RISK UNCERTAINTY ANALYSIS

The baseline HHRA for Site 1120 was performed in accordance with current FDEP guidance. However, there are varying degrees of uncertainty associated with the HHRA. This section presents a summary of uncertainties inherent in the risk assessment for Site 1120 and includes a discussion of how they may affect the quantitative risk estimates and conclusions of the risk analysis.

3.6.1 Usability and Completeness of Existing Databases

Data from soil samples collected in June 2000 and groundwater sample collected in December 2007 were used to assess risks to potential human receptors at Site 1120. The soil data were generally biased because samples were collected in areas of known or suspected contamination. For example, the samples were collected on the basis of headspace screening results, proximity to elevated groundwater concentrations, or areas of staining or odor. The groundwater evaluation was based on fifteen samples collected in 2007 which are expected to represent current conditions at the site. All the data were validated according to USEPA guidance.

3.6.2 Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arose because of the determination of land use conditions, the methods used to calculate EPCs, the selection of receptors and scenarios, and the selection of exposure parameters. Each of these is discussed below.

Land Use

The current land use patterns at OLF Bronson are well established, thereby limiting the uncertainty associated with land use assumptions. Site 1120 is located in a recreational area and is expected to remain so as long as OLF Bronson remains open. To be conservative, risks to potential and future construction workers, fulltime occupational workers, and on-site residents were estimated for the site. No exposures are expected to occur under current land use. Construction workers are considered to be the most likely receptors under future land use. Recreational users were not evaluated in the risk assessment because the contamination of concern at Site 1120 is located 10-12 feet bgs.

Exposure Point Concentrations

Because the soil dataset consisted of less than 10 samples, the EPCs used to evaluate risks for soil were the maximum detected concentrations. Use of the maximum concentration as the EPC tends to overestimate potential risks because receptors are assumed to be exposed continuously to the maximum concentration for the entire exposure period. Uncertainty was also introduced when the nondetects results were assigned a value of one-half the nondetect quantitation limit in the calculation of the benzo(a)pyrene equivalent for soil. This may either overstate or understate the risks to potential receptors.

Groundwater was evaluated by comparing the concentrations in each monitoring well to GCTLs. There is uncertainty in assuming that current groundwater concentrations will not change in the future and this introduces additional uncertainty in the EPCs and risks for potential groundwater COCs. Concentrations in groundwater may diminish over time due to natural attenuation processes involving source depletion and dilution. This is an important consideration for Site 1120 because remediation has already occurred at the site and the source of contamination has been removed.

Exposure Routes and Receptor Identification

The determination of various receptor groups and exposure routes of potential concern was based on current land use and potential future land use. Although residential use of groundwater was evaluated as an exposure scenario, groundwater is not currently used at the site nor is it expected to be used in the future. The evaluation of direct exposure to groundwater in the HHRA was included primarily to aid in risk

management decision making. The only receptor likely to be exposed to the subsurface soil contamination at the site is the future construction worker. Future residents and future fulltime workers could only be exposed to contaminants in soil if residences or buildings were constructed on the site in the future and the subsurface soil were brought to the surface. This is not likely to occur at OLF Bronson and the residential and industrial scenarios were evaluated primarily for informational purposes.

Exposure Parameters

The exposure factors used to calculate the risk-based SCTLs and GCTLS used in this report, in most cases, were obtained from USEPA or Florida guidance documents for the Reasonable Maximum Exposure (RME), which generally specify the use of the 95th percentile value for most parameters. Therefore, the selected values for the RME receptor represented an upper bound of the observed or expected habits of the majority of the population. For example, construction workers were assumed to be exposed to soil and groundwater 250 days per year based on current USEPA guidance (USEPA, December 2002). This is probably an overestimate considering the small areas of contamination present at the site.

For many parameters for which limited information exists (i.e., dermal absorption of chemicals from soil), greater uncertainty exists. For example, current USEPA dermal guidance (USEPA, July 2004) does not provide dermal absorption factors for exposure to volatile organic chemicals in soil. Therefore, exposure from dermal contact with soil was not included in the construction worker SCTL calculations for volatiles in this risk assessment. Consequently, risks from exposure to soil may have been underestimated. However, the underestimation is considered minimal because only one volatile (toluene) was detected in the subsurface soil samples and the concentrations of toluene (0.0012 – 0.0015 mg/kg) were well below the residential, industrial, and construction worker SCTLs.

The FDEP GCTLs used to assess risks for groundwater are based on ingestion only and the calculated GCTLs for construction workers were based on ingestion and dermal contact. Inhalation effects are not considered in the GCTL calculations. For some chemicals (i.e., volatiles) the omission of the aqueous inhalation pathway could result in an underestimation of risk. Note that the GCTL for only one volatile chemical (chloroform) detected in groundwater at Site 1120 is a risk-based value.

3.6.3 Uncertainty in the Toxicological Evaluation

The risk-based concentrations used to assess risk were developed using the toxicity criteria discussed in Section 3.3. Uncertainties associated with the toxicity assessment (determination of RfDs and CSFs and use of available criteria) are presented in this section. The CSFs and RfDs used to calculate the CTLs were obtained from the USEPA and FDEP sources listed in Section 3.3. Surrogate toxicity values were

not used for any of the calculated CTLs. Therefore, the uncertainty associated with CSFs and RfDs is considered to be negligible.

3.7 SUMMARY AND CONCLUSIONS

The HHRA conducted for OLF Bronson Site 1120 was based on chemicals detected in subsurface soil samples collected in 2000 and groundwater samples collected at the site in 2007. The evaluation was conducted using the State of Florida regulations and guidelines specified in Chapters 62-780 F.A.C. and 62-777 F.A.C. The results of the risk assessment are summarized in the following sections.

The risk assessment evaluated risks for hypothetical future residents and fulltime industrial workers using the published SCTLs and GCTLs for the residential and industrial land use scenarios. Risks for future construction workers were evaluated using SCTLs and GCTLs developed for this risk assessment as stipulated in the State of Florida regulations and guidelines. The following chemicals were identified as potential COCs for subsurface soils based on a comparison of maximum concentrations to the SCTLs:

POTENTIAL COCS - SUBSURFACE SOIL EVALUTION

Residential	Industrial	Construction Worker
Carcinogenic PAHs	---	---

As discussed previously, there is considerable overestimation of risk in the residential subsurface soil evaluation because PAHs were detected in only one sample at a depth of 10 – 12 feet bgs. It is unlikely that future residents would be exposed to soil at this depth. In addition, the site is currently located in an area used for recreational purposes and is anticipated that the site will not be developed for residential purposes in the foreseeable future.

The following chemicals were identified as potential COCs for groundwater based on a comparison of maximum concentrations to GCTLs:

POTENTIAL COCS – GROUNDWATER EVALUATION

Residential	Natural Attenuation Criteria	Construction Worker
1-Methylnaphthalene	---	---
2-Methylnaphthalene	---	---
Naphthalene	---	---
TRPH	---	---

Chemicals detected in soil were also evaluated for the potential to impact groundwater quality at the site by comparing maximum concentrations with FDEP SCTLs for migration from soil to groundwater. This evaluation indicated that that the concentrations of constituents detected in subsurface soil are not likely to adversely impact groundwater quality.

4.0 CONCLUSIONS AND RECOMMENDATIONS

TtNUS is proposing a risk-based closure for Site 1120. This Risk-Based Closure Request includes the site history, current site conditions, site risk assessment, and site closure recommendations to support the risk management decisions for Site 1120.

The data used in this closure request includes soil data collected in June 2000 and groundwater monitoring data collected from June 2003 through December 2007.

4.1 SITE CLOSURE RECOMMENDATIONS

Current site conditions are protective of human health, public safety, and the environment, and there are no current exposures to residually contaminated soil or groundwater. Based on the data and risk assessment included in this closure request, No Further Action Status, per FAC 62-780 RMO – Level II, is recommended for the site. The rationale for this recommendation is provided below.

4.1.1 LNAPL

LNAPL is not present at the site and was never detected in any of the historical sampling at the site.

4.1.2 Source Removal/Implemented Remedial Actions

The USTs and approximately 200 cubic yards of soil were removed from the site in 1994. Clean soil was used to backfill the site following the removal action.

An initial groundwater Treatability Study at the site was started in June 2003 and included injection of ORC® in 2003. Quarterly monitoring of the groundwater at the site following the ORC® injection was conducted from September 2003 to October 2005. Additional groundwater samples were collected in December 2007.

4.1.3 Soil

Only one chemical, benzo(a)pyrene, is identified in the subsurface soil as a COC for risk assessment based on exceeding the direct-exposure residential SCTL. Subsurface soil does not exceed direct-exposure industrial SCTLs for any of the chemicals detected in the samples. Site soil does not present unacceptable risks for current or future exposures (other than future residential exposure). If construction work is to be conducted in this area, risk estimates suggest that no special precautions are needed. It is unlikely that residential use of this property will occur in the future. However, if developed, future

residents may be exposed to unacceptable levels of carcinogenic PAHs if subsurface soil is brought to the surface during development. Therefore, institutional controls to prevent residential development are justified.

Concentrations of the chemicals detected in the soil samples do not exceed leachability SCTLs. Therefore the potential leaching of residual constituents from soil to groundwater is no longer a migration pathway of concern for this site.

Because the contamination is limited to subsurface soil and groundwater, no surface runoff of contamination and subsequent discharge to surface water is expected at the site. This results in an incomplete exposure pathway for residual contaminated subsurface soil to impact ecological receptors.

4.1.4 Groundwater

Evaluation of the quarterly monitoring data following the injection of ORC® and data from a subsequent round of sampling (December 2007) indicates that the contaminant concentrations have generally decreased over time. In the most recent data, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene were the only constituents that exceeded GCTLs. However, the concentrations for all of these constituents were below NADSCs (see Table 3-5). The contamination is limited to one monitoring well (MW-14R) and the contamination is not migrating. Overall contaminant concentrations at the site are decreasing, and the concentrations of 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene in well MW-14R are likely to follow that trend.

Site groundwater does not present unacceptable risks for current or future exposures (other than residential). At the present time, there is no potable use of groundwater at OLF Bronson. If construction work is to be conducted in this area, risk estimates suggest that no special precautions are needed.

It is unlikely that residential use of the property will occur in the future. However, if developed, future residents may be exposed to unacceptable levels of carcinogenic PAHs if groundwater in the area was developed as a source of potable water. Therefore, institutional controls to prevent residential development are justified.

RMO – Level II applies to the groundwater at this site under Option IID. Although groundwater concentrations exceed GCTLs in MW-14R, the following conditions are met:

- Historical data indicate that contamination has not been detected in the most downgradient wells. Since these wells are within the property boundaries, groundwater concentrations at the property boundaries are not expected to exceed GCTLs.

- The data indicate that groundwater in only one well (MW-14R) exceeds the GCTLs (concentrations in this well are decreasing). Therefore, contamination is limited to an area less than ¼ acre. The data also indicate that the contamination is not migrating.
- There are no fresh surface water (FSW) or marine surface water (MSW) bodies in the vicinity of the site. Since the downgradient wells show no impact, the site will not impact any FSW or MSW bodies at the property boundaries.

4.2 PROPOSED INSTITUTIONAL CONTROLS

OLF Bronson is currently used as a recreational area (Blue Angels Recreation Park) and is not expected to be developed for any other uses. The site does not present unacceptable risks for current receptors or future construction workers or future occupational workers. Although it is unlikely that residential use of the property will occur in the future, the site presents unacceptable risks for future residents if the contaminated soil is brought to the surface during development and if the groundwater is used as a source of potable water. Therefore, institutional controls to prevent residential development are justified. It is likely that with natural attenuation, the COC concentrations will decrease over time and this restriction may be removed in the future.

The following institutional controls are recommended for the site to achieve No Further Action with conditional status:

- The site remains a recreational area with institutional controls to prevent residential development
- Institutional controls to prevent potable use of groundwater

REFERENCES

Department of the Navy, February 2001. Conducting Human Health Risk Assessments under the Environmental Restoration Program.

FDEP (Florida Department of Environmental Protection), April 1998. Review Comments on Site Assessment Report for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Tallahassee, Florida.

FDEP, February 2005. Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Division of Waste Management, Tallahassee, Florida,

FDEP, April 2005. Contaminated Site Cleanup Criteria, Chapter 62-780 F.A.C., Division of Waste Management, Tallahassee, Florida.

Navy Public Works Center, March 1998. Site Assessment Report for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Naval Air Station Pensacola, Florida.

State of Florida, April 2005. Contaminated Site Cleanup Criteria, Chapter 62-780 F.A.C.

TtNUS (Tetra Tech NUS, Inc.), May 2001. Site Assessment Report Addendum for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Tallahassee, Florida.

TtNUS, February 2006. Enhanced Natural Attenuation Treatability Study Seventh Quarter Groundwater Monitoring Letter Report for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Tallahassee, Florida.

TtNUS, August 2007. Treatability Study Work Plan for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Tallahassee, Florida.

TtNUS, March 2008. Baseline Sampling Letter Report for Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. Tallahassee, Florida.

U.S. EPA, December 1989. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A). EPA 540/1-89/002. Office of Emergency and Remedial Response, Washington, D.C.

USEPA, December 1991. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Publication 9285.7-01B. Office of Emergency and Remedial Response, Washington, DC. NTIS PB92-963333.

USEPA, May 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington, DC.

USEPA, May 1996. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128, Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA, July 1997. Health Effects Assessment Summary Tables FY 1997. Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA Region 4, May 2000. Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment. Atlanta, Georgia.

USEPA, December 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response 9355.4-24, Washington, D.C.

USEPA, July 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. EPA/540/R/99/005, Office of Emergency and Remedial Response, Washington, D.C.

USEPA Region 9, October 2004. Preliminary Remediation Goals. Update December 28.

USEPA Region 3, October 2007. Region III Risk-Based Concentration Table. Hazardous Waste Management Division, Philadelphia, Pennsylvania.

USEPA, May 2008. Integrated Risk Information System (IRIS) Online at http://www.epa.gov/iris/subst/index.html.

APPENDIX A

HUMAN HEALTH RISK ASSESSMENT SUPPORT

CALCULATION OF SCTLS AND GCTLS FOR THE CONSTRUCTION WORKER

Chemical Intakes Used in Development of Construction Worker SCTLs and GCTLs.

The SCTLs for the construction worker were based on the combined effects of ingestion, inhalation, and dermal contact. The GCTLs for the construction worker were based on the combined effects of ingestion and dermal contact. The equations and exposure assumption for these calculations are presented in the following sections.

3.2.3.1 Incidental Ingestion of Soil

Exposures associated with incidental ingestion were estimated in the following manner (USEPA, December 1989):

$$Intake_{si} = (C_{si})(IR_s)(FI)(EF)(ED)(CF)/(BW)(AT)$$

where:

$Intake_{si}$	=	intake of contaminant "i" from soil (mg/kg/day)
C_{si}	=	concentration of contaminant "i" in soil (mg/kg)
IR_s	=	ingestion rate (mg/day)
FI	=	fraction ingested from contaminated source (dimensionless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
CF	=	conversion factor ($1x10^{-6}$ kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days); for noncarcinogens, AT = ED x 365 days/year; for carcinogens, AT = 70 years x 365 days/year

The construction worker was assumed to ingest 330 mg of soil per day (USEPA, December 2002), 250 days per year for 1 year and weigh 70 kg. A default value of 1.0 (USEPA, December 1989) is recommended for the fraction of soil ingested from the contaminated source.

3.2.3.2 Dermal Contact with Soil

Dermal contact with soil is expected to coincide with incidental ingestion. Exposures associated with the dermal route were estimated in the following manner (USEPA, December 1989 and July 2004):

$$Intake_{si} = (C_{si})(SA)(AF)(ABS)(CF)EF)(ED)/(BW)(AT)$$

where: $Intake_{si}$ = amount of chemical "i" absorbed during contact with soil (mg/kg/day)

C_{si}	=	concentration of chemical "i" in soil (mg/kg)
SA	=	skin surface area available for contact (cm^2/day)
AF	=	skin adherence factor (mg/cm^2)
ABS	=	absorption factor (dimensionless)
CF	=	conversion factor ($1x10^{-6}$ kg/mg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
BW	=	body weight (kg)
AT	=	averaging time (days); for noncarcinogens, AT = ED x 365 days/year; for carcinogens, AT = 70 years x 365 days/year

The head, hands, and forearms of the excavation/construction worker were assumed to be exposed to soils (assuming the receptors wear a short-sleeved shirt, long pants, and shoes). As recommended in the Risk Assessment Guidance for Superfund (RAGS) Part E (USEPA, July 2004), the skin surface area for a worker was assumed to be 3,300 cm^2. This value represents the average of the 50^{th}-percentile areas of males and females more than 18 years old. The soil adherence factor for the construction worker was assumed to be 0.3 mg/cm^2. This value is the 95^{th}-percentile value for construction workers, (Exhibit 3.3; USEPA, July 2004).

For the constituents identified as potential COCs for soil, the following dermal absorption factors were used (USEPA, Exhibit 3-4, July 2004):

- PAHs – 0.13
- Petroleum Hydrocarbons – 0.1
- VOCs – None

As indicated in RAGS Part E, absorption factors for VOCs in soil have not been developed due to insufficient data. Therefore, risks from dermal absorption of VOCs in soil were not included in the SCTL calculations. The same exposure frequencies and durations used in the estimation of ingestion intakes were used to estimate exposure via dermal contact.

3.2.3.3 Inhalation of Air and Fugitive Dust/Volatile Emissions

The amount of a chemical a receptor takes in as a result of breathing is determined using the concentration of the contaminant in air. Intakes of both particulates and vapors/gases are calculated using the same equation, as follows (USEPA, December 1991 and July 1996):

$$Intake_{ai} = \frac{(C_{ai})(IR_a)(ET)(EF)(ED)}{(BW)(AT)}$$

where: $Intake_{ai}$ = intake of chemical "i" from air via inhalation (mg/kg/day)
C_{ai} = concentration of chemical "i" in air (mg/m^3)
IR_a = inhalation rate (m^3/hour)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (year)
PEF = Particulate Emission Factor (m^3/kg)
VF = Volatilization Factor (chemical-specific) (m^3/kg)
BW = body weight (kg)
AT = averaging time (days);
= for noncarcinogens, AT = ED x 365 days/year;
= for carcinogens, AT = 70 year x 365 days/year

The same exposure frequencies and durations used in the estimation of ingestion and dermal intakes of soil were used to estimate exposure via inhalation of air and fugitive dust/volatile emissions. The inhalation rate for construction/excavation workers was assumed to be 2.5 cubic meters (m^3) per hour (USEPA, December 2002) for 8 an hour workday (i.e., 20 m^3 per day).

The concentrations of chemicals in air resulting from emissions from soil were developed following procedures presented in USEPA Soil Screening Guidance (July 1996 and December 2002b), as follows:

$$C_a = C_s \times \left[\frac{1}{PEF} + \frac{1}{VF}\right]$$

where: C_a = chemical concentration in air, mg/m^3
C_s = chemical concentration in soil, mg/kg
PEF = Particulate Emission Factor, 2.43 x 10^6 m^3/kg (USEPA, December 2002)
VF = chemical-specific Volatilization Factor, m^3/kg

For chemicals in soil that are not classified as volatile, the above equation reduces to:

$$C_a = C_s \times \left[\frac{1}{PEF}\right]$$

The Particulate Emissions Factor (PEF) relates the concentration of the chemical in soil with the concentration of dust particles in air. The Volatilization Factor (VF) relates the concentration of the chemical in soil with the concentration in ambient air. The VFs used to calculate the alternate SCTLs used in this report were the VFs for workers presented in Table 4 of the 62-777 Technical Report (FDEP, February 2005). The PEF used for the construction worker was 2.43 x 10^6 m^3/kg and was based on USEPA guidance (USEPA, December 2002). The calculation of the construction worker PEF is presented in this Appendix.

3.2.3.4 Incidental Ingestion of Groundwater – Construction Worker

This scenario assumes that construction workers accidentally ingest small amounts of water while working in an excavated area or trench which contains pools of shallow groundwater. The following intake equation and exposure parameters in the groundwater ingestion calculation:

$$Intake_{wi} = \frac{(C_{wi})(IR_w)(EF)(ED)}{(BW)(AT)}$$

where:

$Intake_{wi}$	=	intake of chemical "i" from water (mg/kg/day)
C_{wi}	=	concentration of chemical "i" in water (mg/L)
IR_w	=	ingestion rate of groundwater (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
BW	=	body weight (kg)
AT	=	averaging time (days); for noncarcinogens, AT = ED x 365 days/year; for carcinogens, AT = 70 years x 365 days/year

This scenario assumes that the construction worker accidentally ingests 0.05 mL of groundwater per day 250 days per year for 1 year.

3.2.3.5 Dermal Contact with Groundwater - Construction Worker

Dermal contact with groundwater for the construction worker is expected to coincide with incidental ingestion. The following equation was used to assess exposures resulting from dermal contact with water (USEPA, July 2004):

$$DAD_{wi} = \frac{(DA_{event})(EV)(ED)(EF)(A)}{(BW)(AT)}$$

where:

DAD_{wi}	=	dermally absorbed dose of chemical "i" from water (mg/kg/day)
DA_{event}	=	absorbed dose per event (mg/cm^2-event)
EV	=	event frequency (events/day)
ED	=	exposure duration (years)
EF	=	exposure frequency (days/year)
A	=	skin surface area available for contact (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days) for noncarcinogens, AT = ED x 365 days/year for carcinogens, AT = 70 years x 365 days/year

The exposed surface area of the body available for contact was assumed to be similar to the assumptions outlined for dermal contact with soil, 3,300 cm^2. The workers were also assumed to be exposed 8 hours per day, 250 days per year for 1 year.

The absorbed dose per event (DA_{event}) was estimated using a non-steady-state approach for organic compounds and a traditional steady-state approach for inorganics. For organics, the following equations apply:

$$\text{If } t_{event} < t^*, \text{ then: } DA_{event} = (2)(K_p)(FA)(C_{wi})(CF)\left(\sqrt{\frac{6\,\tau\, t_{event}}{\pi}}\right)$$

$$\text{If } t_{event} > t^*, \text{ then: } DA_{event} = (K_p)(FA)(C_w)(CF)\left(\frac{t_{event}}{1+B} + 2\tau\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right)$$

where:

t_{event}	=	duration of event (hours/event)
t^*	=	time it takes to reach steady-state conditions (hours)
K_p	=	permeability coefficient from water through skin (cm/hour)
FA	=	chemical-specific fraction absorbed (dimensionless)
C_{wi}	=	concentration of chemical "i" in water (mg/L)
τ	=	lag time (hour)
π	=	Pi (dimensionless; equal to 3.1416)
CF	=	conversion factor (0.001 L/cm^3)

B = dimensionless ratio of the permeability of the stratum corneum relative to the permeability across the viable epidermis

Values for the chemical-specific parameters (t^*, K_p, τ, FA, and B) were obtained from RAGS Part E, the current dermal guidance (USEPA, July 2004), and are presented in Appendix A. If no published values were available for a particular compound, values were calculated using equations provided in this guidance. Note that for PAHs in groundwater, exposure by dermal contact was not included in the GCTL calculations because USEPA dermal guidance (USEPA, July 2004) indicates that there is a great deal of uncertainty and overestimation of exposure in the model used to estimate the permeability of aqueous PAHs through the skin. In addition, Tetra Tech Inc. has been advised by USEPA Region 4 not to calculate risks from PAHs in water because tests have shown that PAHs in water do not penetrate the skin. Details and calculations of the construction worker GCTLs are presented in Appendix A.

CALCULATION WORKSHEET

CLIENT: SITE 1120		**JOB NUMBER:** 00705
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 7/28/2005

PURPOSE: To calculate an alternative soil cleanup level for consturction workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = CSFo \times IRo \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Der} = CSFd \times SA \times AF \times DA \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Inh} = CSFi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	**Benzo(a)pyrene (cPAHs)**	
SCTL	=		Soil Cleanup Target Level (mg/kg)
TR	=	1.0E-06	Target Cancer Risk (unitless)
BW	=	70	Body weight (kg)
AT	=	25550	Averaging time (days)
EF	=	250	Exposure frequency (days/year)
ED	=	1	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	330	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.13	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	2.72E+07	Volatilization factor (m^3/kg)
PEF	=	2.43E+06	Particulate emission factor (m^3/kg)
CSFo	=	7.30E+00	Oral cancer slope factor $(mg/kg/day)^{-1}$
CSFd	=	7.30E+00	Dermal cancer slope factor $(mg/kg/day)^{-1}$
CSFi	=	3.10E+00	Inhalation cancer slope factor $(mg/kg/day)^{-1}$

CLIENT: SITE 1120		**JOB NUMBER:** 00705
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 7/28/2005

EXAMPLE CALCULATION - BENZO(A)PYRENE

$Intake_{Ing}$ = 7.30E+00 (mg/kg-day)-1 x 330 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 2.41E-03 kg-kg/mg

$Intake_{Der}$ = 7.30E+00 (mg/kg-day)-1 x 3300 cm2/day x 0.3 mg/cm2 x 0.13 x 1E-06 kg/mg

$Intake_{Der}$ = 9.40E-04 kg-kg/mg

$Intake_{Inh}$ = 3.10E+00 (mg/kg-day)-1 x 20 m3/day x (1/2.72E+07 m3/kg + 1/2.43E+06 m3/kg)

$Intake_{Inh}$ = 2.78E-05 kg-kg/mg

$$SCTL = \frac{1.E\text{-}06 \times 70\ kg \times 25550\ days}{250\ days/yr \times 1\ yrs \times 1 \times [2.41E\text{-}03\ kg\text{-}kg/mg + 9.40E\text{-}04\ kg\text{-}kg/mg + 2.78E\text{-}05\ kg\text{-}kg/mg]}$$

SCTL = 2.12E+00 mg/kg

CALCULATION WORKSHEET

CLIENT: SITE 1120		**JOB NUMBER:** 00705
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 5/20/2008

PURPOSE: To calculate an alternative soil cleanup level for consturction workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = 1/RfDo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = 1/RfDd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = 1/RfDi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	**TRPH**	
SCTL	=		Soil Cleanup Target Level (mg/kg)
THI	=	1	Target Hazard Index (unitless)
BW	=	70	Body weight (kg)
AT	=	365	Averaging time (days)
EF	=	250	Exposure frequency (days/year)
ED	=	1	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	330	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.1	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	8.73E+03	Volatilization factor (m^3/kg)
PEF	=	2.43E+06	Particulate emission factor (m^3/kg)
RfDo	=	4.0E-02	Oral reference dose (mg/kg/day)
RfDd	=	4.0E-02	Dermal reference dose (mg/kg/day)
RfDi	=	5.7E-02	Inhalation reference dose (mg/kg/day)

CALCULATION WORKSHEET

CLIENT: SITE 1120		**JOB NUMBER:** 00705
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 5/20/2008

EXAMPLE CALCULATION - TRPH

$Intake_{Ing}$ = 1/4.0E-02 mg/kg-day x 330 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 8.25E-03 kg-kg/mg

$Intake_{Der}$ = 1/4.0E-02 mg/kg-day x 3300 cm2/day x 0.3 mg/cm2 x 0.1 x 1E-06 kg/mg

$Intake_{Der}$ = 2.48E-03 kg-kg/mg

$Intake_{Inh}$ = 1/5.7E-02 mg/kg-day x 20 m3/day x (1/8.73E+03 m3/kg + 1/2.43E+06 m3/kg)

$Intake_{Inh}$ = 4.02E-02 kg-kg/mg

$$SCTL = \frac{1 \times 70 \text{ kg} \times 365 \text{ days}}{250 \text{ days/yr} \times 1 \text{ yrs} \times 1 \times [8.25E\text{-}03 \text{ kg-kg/mg} + 2.48E\text{-}03 \text{ kg-kg/mg} + 4.02E\text{-}02 \text{ kg-kg/mg}]}$$

SCTL = 2.01E+03 mg/kg

CALCULATION WORKSHEET

CLIENT:	JOB NUMBER:
SITE 1120	00705
SUBJECT: CALCULATION OF PARTICUALATE EMISSION FACTOR FOR CONSTRUCTION WORKERS	
BASED ON: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, December 2002)	

BY:	CHECKED BY:	DATE:
T.JACKMAN		05/22/08

Equation 5-5
Derivation of the Particulate Emission Factor
Construction Scenario - Construction Worker

$$PEF_{sc} \cdot Q/C_{sr} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left(\frac{W}{3}\right)^{0.4} \times \frac{(365d/yr - p)}{365d/yr} \times \cdot \ VKT} \right]$$

Parameter/Definition (units)	Default
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	site-specific
Q/C_{sr}/ inverse of 1-h average air concentration along a straight road segment bisecting a 0.5-acre square site (g/m^2-s per kg/m^3)	23.02
F_D/dispersion correction factor (unitless)	0.185 (Appendix E)
T/total time over which construction occurs (s)	site-specific
A_R/surface area of contaminated road segment (m^2) L_R/length of road segment (ft) W_R/width of road segment (ft)	274.213 ($A_R = L_R \times W_R \times 0.092903 m^2/ft^2$)
W/mean vehicle weight (tons)	site-specific
p/number of days with at least 0.01 inches of precipitation (days/year) (see Figure 5-2)	site-specific
• VKT/sum of fleet vehicle kilometers traveled during the exposure duration (km)	site-specific

Calculation of PEF for Construction Workers

Q/C	23.02	(g/m2-s per kg/m3)	
Fd	0.185	dispersion correction factor (unitless)	
T	7.20E+06	sec	3600 sec/hr x 8hr/day x 250days/yr
Area (A)	274.213	m^2	
W	8	tons	
p	110	day/year	
VKT	175.5	km	

PEF = 2.43E+06 m^3/kg

EXPOSURE ASSUMPTIONS FOR EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER

Exposure Route	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	Max or 95% UCL	ug/L	USEPA, December 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
	CR	Contact Rate	0.05	L/day	Professional Judgement	
	CF	Conversion factor	0.001	ug/mg	- -	
	ET	Exposure Time	NA	hours/event	- -	$\frac{CW \times CF \times IR\text{-}GW \times EF \times ED}{BW \times AT}$
	EF	Exposure Frequency	250	events/year	USEPA, December 2002	
	ED	Exposure Duration	1	years	Professional Judgement	
	BW	Body Weight	70	kg	U.S. EPA, 1993	
	AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	
Dermal	DAevent	Absorbed dose per event	Calculated	mg/cm2-event	US.EPA, July 2004	Dermally Absorbed Dose (mg/kg/day) =
	SA	Skin Surface Available for Contact	3,300	cm2	US.EPA, July 2004	
	EV	Event Frequency	1	events/day	Professional Judgement	$\frac{DAevent \times EV \times EF \times ED \times SA}{BW \times AT}$
	ET	Exposure Time	8	hours/event	8 Hour Workday	
	EF	Exposure Frequency	250	days/year	Professional Judgement	
	ED	Exposure Duration	1	years	Professional Judgement	See text for calculation of DAevent.
	BW	Body Weight	70	kg	U.S. EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	365	days	U.S. EPA, 1989	

Noncancer Ingestion Intake = 4.89E-07 ɪrmal Intake = 3.23E+01

TOXICOLOGICAL DATA FOR CALCULATION OF GROUNDWATER CTLS FOR CONSTRUCTION WORKERS

Chemical	RfDo mg/kg/d		CSFo 1/mg/kg/d		Oral to Dermal Adjustment	RfDd mg/kg/d		CSFd 1/mg/kg/d	
Chloroform	1.00E-02	i			1	1.00E-02			
Ethylbenzene	1.00E-01	i			1	1.00E-01			
Xylenes	2.00E-01	i			1	2.00E-01			
1-Methylnaphthalene	4.00E-03	i			1	4.00E-03			
2-Methylnaphthalene	4.00E-03	i			1	4.00E-03			
Naphthalene	2.00E-02	i			1	2.00E-02			
Acenphthene	6.00E-02	i			1	6.00E-02			
Fluorene	4.00E-02	i			1	4.00E-02			
Phenanthrene	3.00E-02	i			1	3.00E-02			
TRPH	4.00E-02	i			1	4.00E-02			

CALCULATION OF Dvevent FOR EXPOSURES TO GROUNDWATER - CONSTRUCTION WORKER
SOURCE: RISK ASSESSMENT GUIDANCE FOR SUPERFUND, PART E, SUPPLEMENTAL GUIDANCE FOR DERMAL RISK ASSESSMENT INTERIM GUIDANCE

RELEVANT EQUATIONS:

For Inorganics DAevent = Kp x Cw x CF x tevent

For Organics If $tevent \le t^*$, then: $DAevent = 2 \times FA \times Kp \times Cw \times CF \times \sqrt{\frac{6 \times tau \times tevent}{\pi}}$

If $tevent > t^*$, then: $DAevent = FA \times Kp \times Cw \times CF \times \left[\frac{tevent}{1+B} + 2 \times tau \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$

DAevent = :		Chemical specific absorbed dose per event (mg/cm^2-event)
Cw = :		Concentration of chemical in water (ug/L)
tevent = :	8	duration of event (hr/event)
tau = :		Chemical specific lag time (hr)
t* = :		Chemical specific time it takes to reach steady state (hr)
B = :		Chemical specific dimensionless constant
Kp = :		Chemical specific permeability constant (cm/hr)
CF = :	1.0E-06	(L/cm3)(mg/ug)
FA = :		Fraction absorbed (dimensionless)

CHEMICAL	Cw (ug/L)	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DAevent (mg/cm^2 - event)
Chloroform	1	O	6.83E-03	1	4.98E-01	2.87E-02	1.19E+00	6.01E-08
Ethylbenzene	1	O	4.93E-02	1	4.20E-01	1.95E-01	1.01E+00	3.79E-07
Xylenes	1	O	5.00E-04	1	1.34E-01	2.45E-04	3.22E-01	4.13E-09
1-Methylnaphthalene	1	O	9.08E-02	1	6.58E-01	4.16E-01	1.58E+00	6.78E-07
2-Methylnaphthalene	1	O	8.94E-02	1	6.58E-01	4.10E-01	1.58E+00	6.69E-07
Naphthalene	1	O	4.66E-02	1	5.58E-01	2.03E-01	1.34E+00	3.72E-07
Acenphthene	1	O	8.39E-02	1	7.68E-01	4.01E-01	1.84E+00	6.55E-07
Fluorene	1	O	1.07E-01	1	8.97E-01	5.29E-01	2.15E+00	8.38E-07
Phenanthrene	1	O	1.44E-01	1	1.06E+00	7.40E-01	4.11E+00	1.16E-06
TRPH	1	O	1.16E-02	1	5.81E-01	5.13E-02	1.39E+00	1.03E-07

CALCULATION OF GROUNDWATER CTLS FOR CONSTRUCTION WORKERS

Chemical	Hazard Index (Adult) 1		
	Incidental Ingestion	Dermal Contact	Combined
Chloroform	2.0E+04	5.2E+03	4.1E+03
Ethylbenzene	2.0E+05	8.2E+03	7.9E+03
Xylenes	4.1E+05	1.5E+06	3.2E+05
1-Methylnaphthalene	8.2E+03	NA	8.2E+03
2-Methylnaphthalene	8.2E+03	NA	8.2E+03
Naphthalene	4.1E+04	NA	4.1E+04
Acenphthene	1.2E+05	NA	1.2E+05
Fluorene	8.2E+04	NA	8.2E+04
Phenanthrene	6.1E+04	8.0E+02	6.1E+04
TRPH	8.2E+04	1.2E+04	1.1E+04